

Compressed Air

MARCH 1955

Magazine



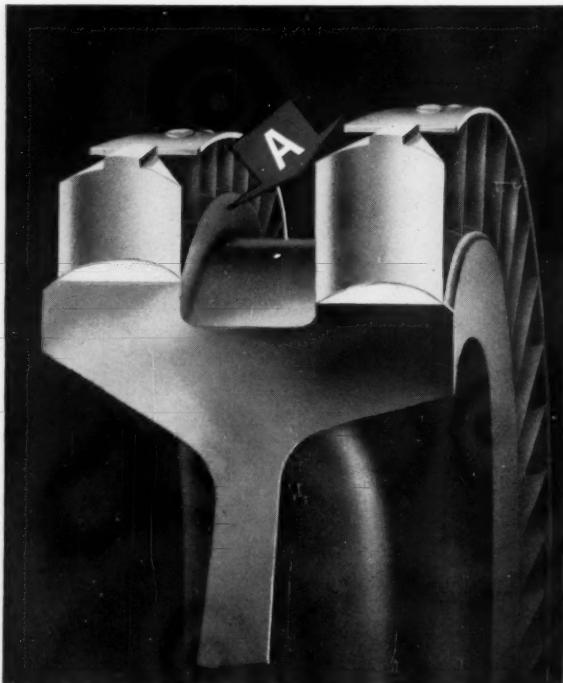
CONSTRUCTION OF
NATIONAL CAPITOL

Old picture by unidentified
photographer shows work
on Washington edifice

WIDE WORLD PHOTO

VOLUME 60 • NUMBER 3

NEW YORK • LONDON



(Left, A) wide bucket "L" type wheel. (Right, B) regular type wheel for Coppus Steam Turbines

Now...for low steam consumption —
COPPUS TURBINES *can be furnished*
with wide bucket "L" type wheel

Good news for steam turbine users where low steam consumption is important!

The Coppus Type "L" Wheel is the answer to this problem. Larger turbine buckets are employed to make the most economical use of steam.

In every respect the Coppus Turbine offers the top-quality features and advantages that have made the Coppus line outstanding for efficiency and economy. For example:

- Turbines rated close to your exact hp

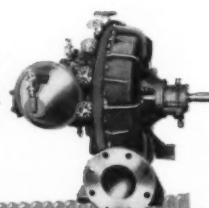
requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.

- A larger number of steam nozzles, controlled individually by manually operated valves.

- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.

Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, *make turbine dollars go farther*. Send for Bulletin 135 on Coppus Turbine.

COPPUS
ENGINEERING
CORPORATION
203 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS'
REGISTER



COPPUS "BLUE RIBBON" TURBINES

Clean, Dry Air

WITH
STAYNEW
PIPE LINE FILTERS

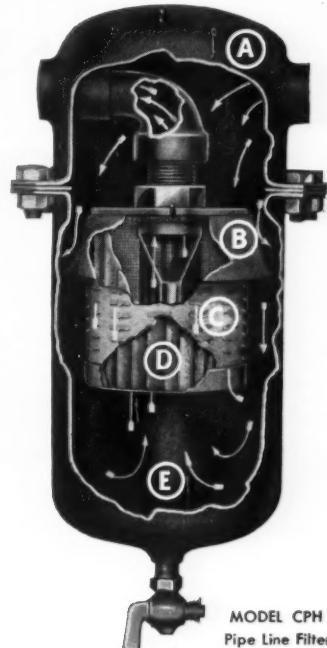
**ASSURES CONTINUOUS OPERATION
OF COMPRESSED AIR EQUIPMENT**

And Here's Why . . .

Air operated tools, instruments, processes and pneumatic controls have one thing in common . . . they *thrive on clean, dry air*. With few exceptions, all breakdowns, repairs, and loss of productive time can be avoided by filtering air and other gases through Staynew Pipe Line Filters. Wherever air must be kept clean and dry for industrial equipment, filter it with Staynew.

Send for complete illustrated catalog on Staynew Pipe Line Filters. Write today!

Representatives in Principal Cities



MODEL CPH
Pipe Line Filter

- A. Heavy pressed steel head and body.
- B. Deflector cup.
- C. Louvred housing.
- D. Radial fin filter insert.
- E. Large capacity base.

*MODEL CPH	Horizontal Pressure Type
MODEL CP	Vertical Pressure Type
MODEL CVH	Vacuum Type
*MODEL AAPH	Absorption Type
MODEL HPH	High Pressure Type

*Also available in swing bolt construction for easy inspection and servicing.



DOLLINGER

CORPORATION
7 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Ingersoll-Rand does it again!

New 110,000 sq. ft. condenser, serving
at State Line Station of Chicago

DEMONSTRATES SUPERIOR

The new condenser at Chicago's State Line Station offers another example of the adaptability of Ingersoll-Rand condenser design. It consists of two shells, installed parallel to the shaft of the low-pressure element of the cross-compound steam turbine generator. Each shell has 55,000 sq. ft. condensing surface and forms a unified construction with the turbine's side exhaust which it serves. This forward-looking design for Unit No. 3 eliminates the problems which would have been encountered if vertical condensers had been used in this design.

Ingersoll-Rand surface condensers have long set the pace in central station practice. Back in 1920, the basic principle of the I-R surface condenser was introduced

as an entirely new concept in design. Ever since, an extensive program of research has been carried on to construct condensers that give top performance in minimum space—under any specified operating conditions. This design for the State Line Station is typical of Ingersoll-Rand's leadership in surface condenser progress.

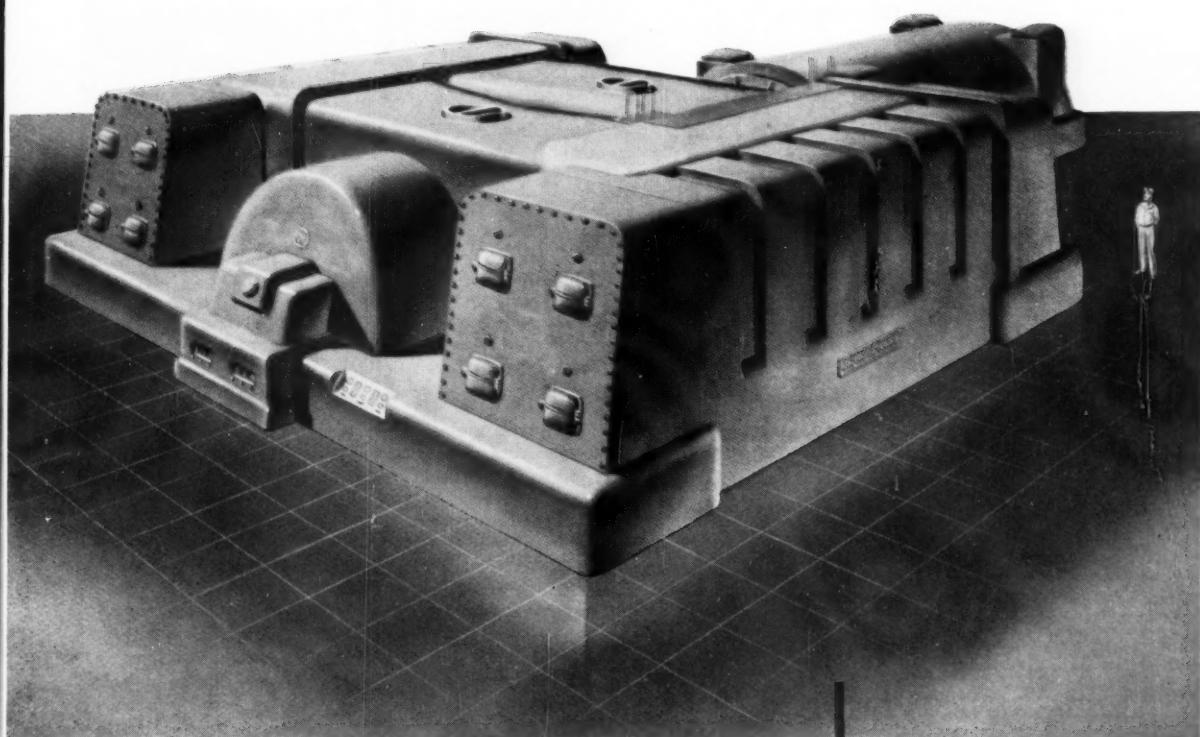
Ingersoll-Rand horizontal condensate pumps will be used—and three I-R 10-stage Class CHTA "double-case" high-pressure boiler feed pumps will also serve Unit No. 3 at State Line. Ask to have an I-R specialist study your power plant equipment needs—and submit recommendations to meet your particular requirements.

*Wholly owned subsidiary of Commonwealth Edison Company

PUMPS * COMPRESSORS * GAS AND DIESEL ENGINES * AIR AND ELECTRIC TOOLS *

191,000 kw Unit No. 3
District Electric Generating Corporation*

ADAPTABILITY OF I-R DESIGN



Ingersoll-Rand
11 Broadway, New York 4, N. Y.

4-126

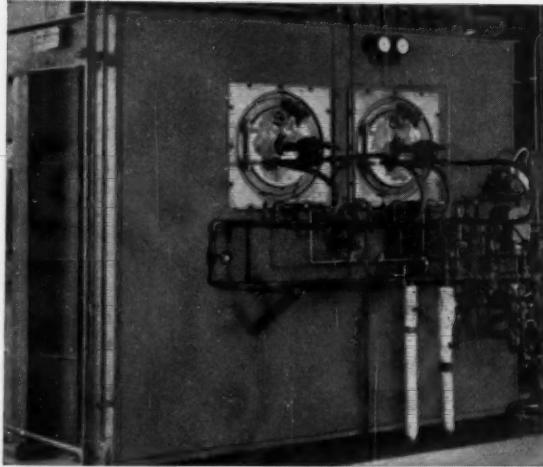
Ingersoll-Rand 110,000 sq. ft. twin-shell surface condenser, to be installed in State Line Station, Chicago District Electric Generating Corporation. Sargent & Lundy, Consulting Engineers.

VACUUM EQUIPMENT • ROCK DRILLS • TURBO-BLOWERS

MARCH, 1955

Circle 3A on reply card

Adv. 5



ANNOUNCING...

The C-E La Mont Controlled Circulation Hot Water Boiler for large heating and process applications

Combustion's high-temperature (H-T) water boiler is especially designed to utilize the inherent advantages of hot water over steam for large central heating installations and for many process applications. Units are available in sizes from 10,000,000 Btu per hour up, for any fuel, with pressures up to 300 psi and water temperatures to about 425 F. The chief advantages of the C-E La Mont Controlled Circulation Hot Water Boiler are:

Complete control — System control over the H-T water movement is extended to the boiler at all heat rates, since the water is under positive, controlled pressure.

Low pressure loss — Because of the low pressure loss inherent in the design, the system circulating pumps can be used to provide circulation through the boiler.

Pressurized operation — Used with oil or gas fired boilers, pressurized operation permits a simple stack arrangement and eliminates the need for induced draft fans.

Single-pass design — Absence of baffles not only assures low draft loss but also a cleaner boiler since there are no dead areas where deposits are likely to accumulate.

Other features — High furnace heat rates and more efficient heat transfer... more efficient, closely spaced heating surface means reduced setting thickness, lighter boiler weight... all boiler tubes are completely drainable... small number of headers, all accessible from outside the completely steel-enclosed setting... suitable for oil, gas or spreader stoker firing... special designs available for other types of firing or waste heat.

In addition to these advantages, in many cases a C-E La Mont installation, as compared to steam, will result in a simpler and less expensive distribution system, and assure lower fuel and maintenance costs. Write for further information.

B-806B

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE





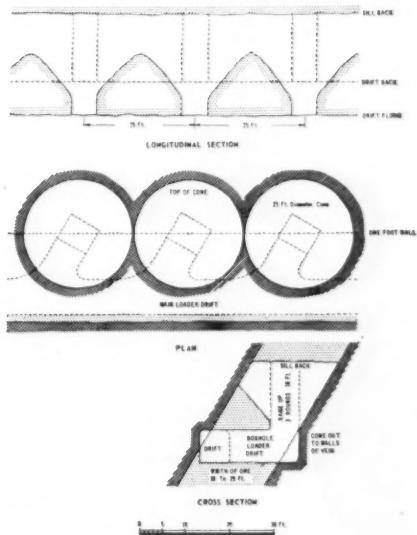
INCREASE PRODUCTION LOWER COSTS

Yes! You can increase production and lower costs by using Eimco loaders to load your production tonnage.

The advantages of being able to load larger pieces, use less powder, practically eliminate secondary blasting and absolutely eliminate expensive chutes and grizzlies, will enable your mine to get into production in a new area faster at less expense.

That's why so many mining men are traveling to see mines that have changed their systems to production loading with Eimcos.

Many different ideas for saving time and lowering costs have been developed by operators to fit their particular conditions. A sketch of one of these is at right. Eimco engineers have helped work out numerous systems, they will be glad to help you. Write Eimco for information.



THE EIMCO CORPORATION
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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You Can't Beat An Eimco



B74

HANDLE
WITH
ABANDON!

U. S. Matchless Wire Braid Air Hose



"U.S." Research perfects it... "U.S." Production builds it... U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes
Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

No "babying" needed here! U. S. Rubber Engineers designed this premium quality hose with more than enough brute strength and stamina to withstand the highest working pressures, the toughest construction conditions.

And U. S. Matchless® has proved its ability to take both use and abuse indefinitely—on jobs around the world—serving long after ordinary hose has been ruined by abrasion, crushing and high pressure.

Yet in spite of its great strength, U. S. Matchless is highly flexible—practically as easy to handle as a garden hose.

Mandrel-made, wrapped-finish U. S. Matchless Wire Braid Air Hose is available in 50 ft. lengths from any of our 27 District Sales Offices, or by writing to the address below. Whatever your hose requirements, you'll find it pays to turn to "U. S." There's a job-engineered U. S. Hose for practically every purpose—a staff of "U. S." Engineers to assist you in your hose selection.



- * tube of high quality neoprene is completely resistant to line oil
- * special steel wire braid gives tremendous strength, permanent bonding assured by heavy gauge rubber layer
- * additional layer of rubber under specially coated rayon breaker protects wire against corrosion should cover be cut or damaged
- * cover of carefully selected, tough brown natural rubber fights off injury from rocks, tools, and heavy equipment

NEW

TOTALLY PROTECTED

A-C.

MOTORS

Yes, it's true!

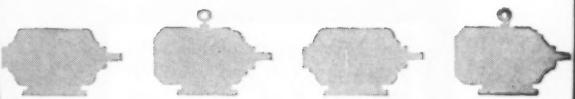
Industry everywhere is checking into the facts about these amazing new *Totally Protected A-c. Motors* by Reliance.

To help you check the facts to see where it fits into *your* production area, we've prepared a booklet called "Check the Facts".

Get your copy today—by mail, or through your local Reliance district sales office or distributor.

B-1489

CHECK
THE
FACTS



RELIANCE ELECTRIC AND
ENGINEERING CO.

Canadian Division: Welland, Ontario

1118 IVANHOE ROAD • CLEVELAND 10, OHIO



Builders of the Tools of Automation



Readily Dismantled

Readily Assembled

180-W

5-cu. yd.

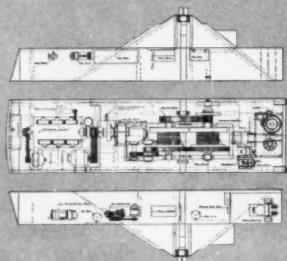
WALKING DRAGLINE



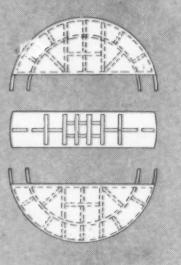
The 180-W is available with 5-yd. bucket and 120-ft. boom; or 4-yd. bucket and 135-ft. boom.

Entire Dragline
Easily Loaded
On Five U. S.
Railroad Cars

Side wings unbolt
from center section
of revolving frame.
Main machinery
remains fully
assembled and in proper
alignment.



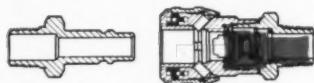
Base is in three
separate welded-
steel sections,
joined by bolting
flanges — easily
disassembled and
shipped.



SPECIFICALLY ENGINEERED...
NEVER MERELY ADAPTED...
FOR EACH PARTICULAR
TYPE OF APPLICATION

HANSEN

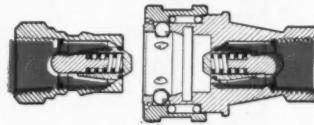
QUICK-CONNECTIVE COUPLINGS



ONE-WAY SHUT-OFF

Shuts off one side of line

Gives quick connection and disconnection, with instant automatic flow or shut-off. To connect Coupling and open line to flow of fluid, merely push Plug into Socket. To disconnect, a slight pull on sleeve releases Plug and shuts off supply end of line.



TWO-WAY SHUT-OFF

Shuts off both sides of line

To connect, pull back sleeve and push Plug into Socket. Identical torpedo type valves permit free flow of gas or liquid through Coupling. To disconnect, pull back sleeve . . . Coupling immediately disconnects, valves automatically seal both ends of line. Female pipe thread connections from $\frac{1}{8}$ " to 1". Available in brass or steel.



STRAIGHT-THROUGH COUPLING

Provides quick connection and disconnection, but does not have shut-off feature. Sizes, ranging from $\frac{1}{4}$ " to $2\frac{1}{2}$ ", carried in stock. Two special types of straight-through steam Couplings also available—one for low pressures, and one for high pressures.

Quick-Connective Fluid Line Couplings for
AIR • OIL • GREASE • HYDRAULIC FLUIDS
REFRIGERANTS • VACUUM • STEAM • OXYGEN
ACETYLENE • GASOLINE • COOLANTS • WATER
Write for Catalog

HOSE CLAMPS • HOSE CLAMP PLUGS
HOSE CLAMP SOCKETS • HOSE CLAMP COUPLINGS
AIR LIQUID SPRAY GUNS • AIR BLOW GUNS
SAND BLAST CLEANERS • ENGINE CLEANERS

SINCE 1915

THE HANSEN



MANUFACTURING COMPANY

4031 WEST 150th STREET

CLEVELAND 11, OHIO

NEW “KING-SIZE” CARTRIDGES SAVE TIME AND LABOR

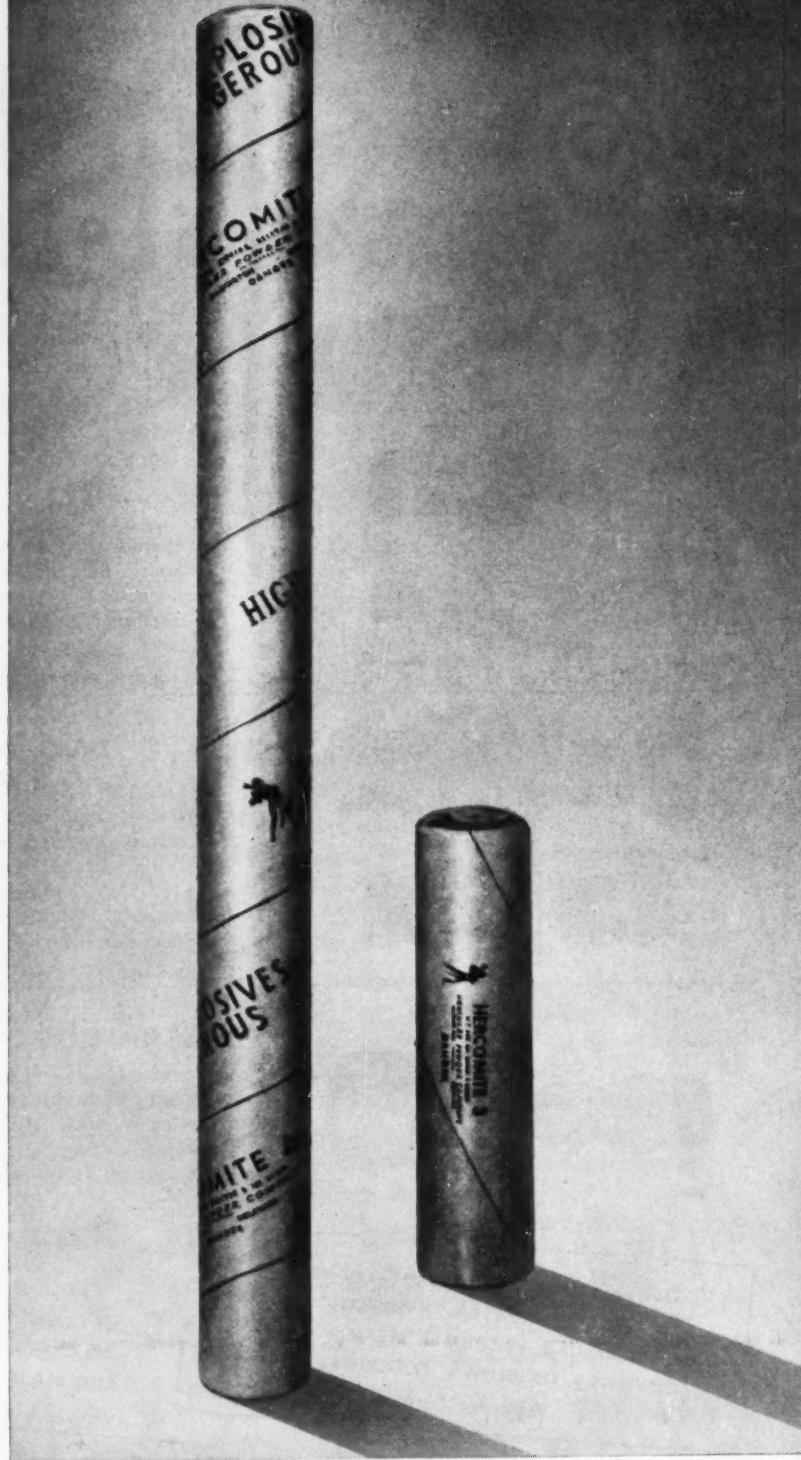
Now, Hercules produces “King-Size” cartridges in lengths of 24, 20, 16 and 12 inches, and in diameters of $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, and 2 inches.

Available in all types of Hercules® dynamite, these long-length, small-diameter cartridges are now in full production.

“King-Size” cartridges make possible a more uniform fragmentation through the discharge of a single column of explosive. Their use means substantial savings in valuable time and labor in loading holes.

Hercules designed, tested, and installed special new packing machines for these “King-Size” cartridges.

Our technical service and sales representatives will be glad to discuss with you how these “King-Size” cartridges can go to work for you.



THREE TIMES AS LONG... Here is one of the new “King-Size” Hercules cartridges—24 inches in length, shown alongside the same grade in the conventional 8 inch size.

HERCULES POWDER COMPANY

Explosives Department, 932 King St., Wilmington, Del.



Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Cal.; New York, N.Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Cal.

HERCULES

for
generating
**AIR
POWER**

SELECT AN INGERSOLL-RAND COMPRESSOR

- If you need air power generated by a compressor using any of these methods of drive —
- If your requirements for compressed air are between a vacuum and 15,000 pounds per square inch —
- If you need a machine within the range of $\frac{1}{2}$ to 4000 hp —

Ingersoll-Rand is the world's largest manufacturer of compressors. The complete line includes more than 1000 sizes and types. Within this extensive selection you will be able to find a compressor to meet your most exacting requirements.

Your nearest Ingersoll-Rand engineer will be glad to help you solve your compressed air problems. He will be able to supply complete information about the compressor you need.



Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N.Y.

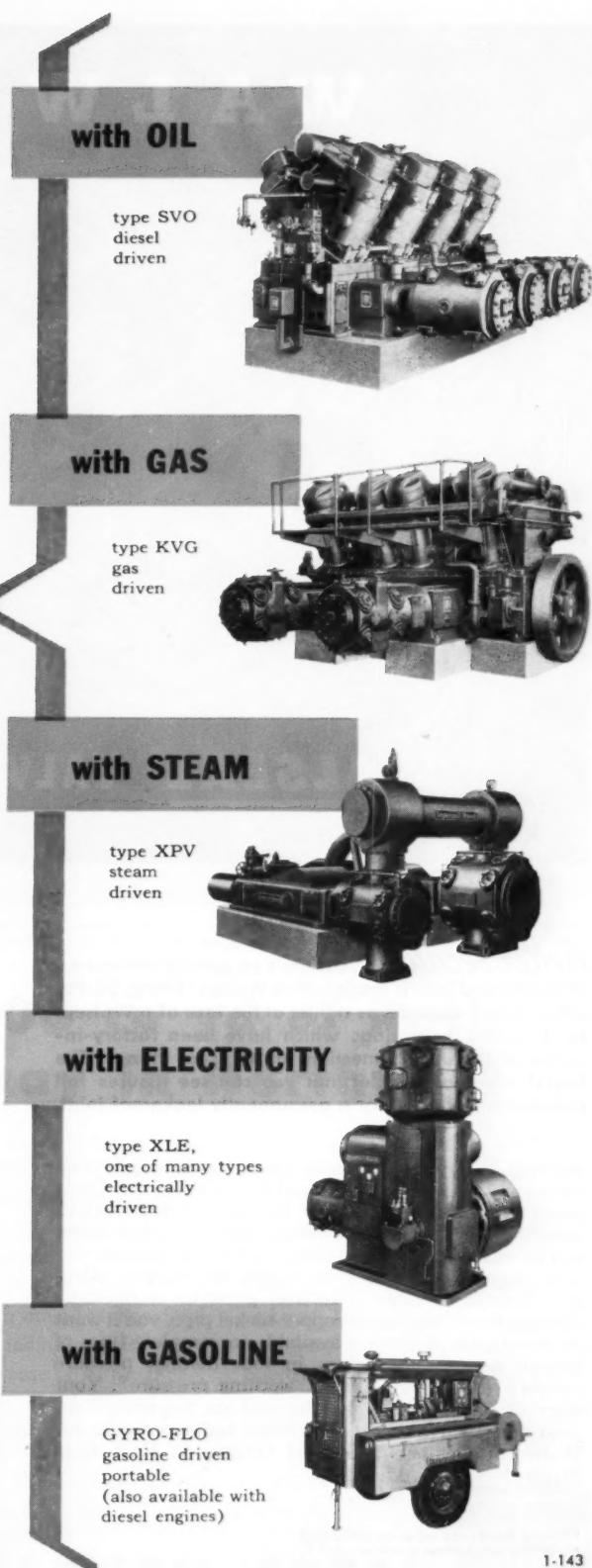
COMPRESSORS • CONDENSERS • BLOWERS • PUMPS • ROCK DRILLS • AIR TOOLS • DIESEL ENGINES

MARCH, 1955

Circle 10A on reply card

Circle 11A on reply card

1-143



ADV. 13

WALWORTH



WALSEAL® VALVES AND FITTINGS

Better because . . . There's no guesswork when a silver-brazed joint is made with a Walseal fitting. Sil-Fos alloy, which appears as a fillet at the face of a Walseal joint, comes from rings which have been factory-inserted in the end connections of Walseal fittings. The bright silver alloy fillet that you can see assures full penetration of alloy for a permanently leakproof joint.

Walseal is a registered trade mark identifying bronze valves and fittings manufactured by the Walworth Company. Walseal products have factory-inserted rings of silver brazing alloy in threadless ports. Walseal joints can be made only with Walseal valves and fittings.

If you're piping water, oil, steam, air, oxygen, nitrogen, helium or other industrial gases or refrigerants through brass, copper, or copper-nickel pipe, you'll want to investigate Walseal — available in complete lines of bronze valves and fittings in four distinct pressure ranges — from 0 to 5000 psi. working pressure*. Your copy of Circular 115 will be sent on request . . . see your near-by Walworth Distributor today, or write to: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

*Walseal fittings and valves are being used at sub-zero temperatures as low as -350 F.



Cutaway view of a Walseal Tee showing: factory-inserted ring of silver brazing alloy; fillet of silver brazing alloy that appears upon completion of Walseal joint; cutaway view of the completed joint showing that silver brazing alloy has flowed in both directions from the factory-inserted ring.

Make it "a one-piece pipeline" with **WALSEAL**



WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



This construction photograph, showing Bethlehem 2-in.-round Hollow Drill Steel mounted in drills, emphasizes the rugged rock formations confronting contractors Slat & Hall, Portland, Ore. The drill steel was reconditioned by Westland Equipment, Portland.

Moving 1,272,000 cu yd of Rock for New Highway in Northwest

There's a lot of formidable rock-covered country along the south bank of the Columbia River, east of The Dalles, Oregon. And removing it was no easy task, as drilling crews learned quickly when initiating a contract for the relocation of 7 miles of U. S. Route 30. Biting into the high bluffs to make blast holes up to 100 ft deep, the contractors used 24-ft lengths of 2-in.-round Bethlehem Hollow Drill Steel, fitted with carbide-insert bits.

This contract, part of the gigantic project under the supervision of the Corps of Engineers, Portland District,

U. S. Army, is required by the construction of the 8500-ft-long The Dalles Dam. Upon completion of the contract, some 1,272,000 cu yd of very hard and medium-hard Columbia basalt will have been excavated.

Bethlehem 2-in.-round Hollow Drill Steel is an outstanding steel for deep-hole drilling because of its toughness and long service life. Analyzing 0.80 carbon, it is a fatigue-resisting steel

with which large bits are used, permitting maximum rock-removal with fewer holes.

It is usually furnished in lengths of 22 ft and 32 ft, and has a $\frac{3}{4}$ -in. centered hole which is both smooth and true. The steel can be easily forged and heat-treated, and has a wide quenching range. It's a good steel to keep in mind whenever deep-rock drilling is scheduled.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Best bet for better bids-

SPECIFY GENERAL MOTORS DIESEL POWER

in all your construction equipment

You can *specify* General Motors Diesel power in over 750 different models of equipment built by over 150 manufacturers.

When you do you'll get fast-acting, quick-accelerating 2-cycle Diesel power that will help you do more work, faster, at less cost.

More work, because a General Motors Diesel is a "high torque" engine. And torque—as much as developed horsepower—measures an engine's working ability.

Faster work, because a GM 2-cycle Diesel, with its responsive governor, efficient fuel injectors and power at every piston downstroke, gives you instant pickup in response to changing loads.

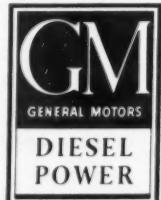
Less cost, because a General Motors Diesel burns fewer gallons of safer, cheaper fuel. Also a GM Diesel costs less to buy and the parts cost less than for other Diesels of comparable ratings.

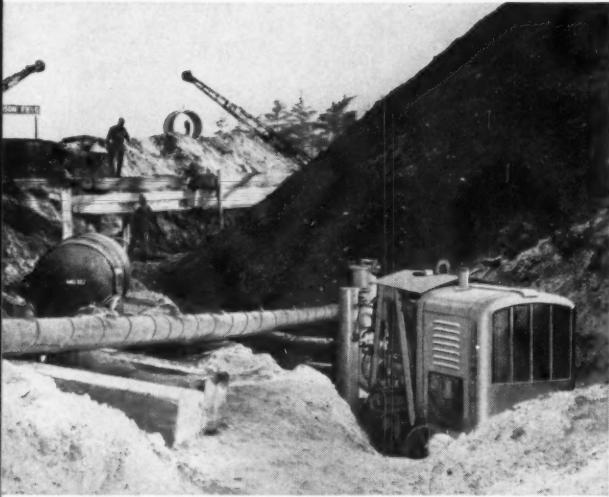
No matter where your contracts take you, you'll find GM Diesel distributors ready to supply fast service and quick delivery of low-cost factory parts. Check your local distributor today for full details on dependable, low-cost Diesel power for your equipment, or write direct for more information.



PURCHASED 23 GM DIESELS SINCE 1947

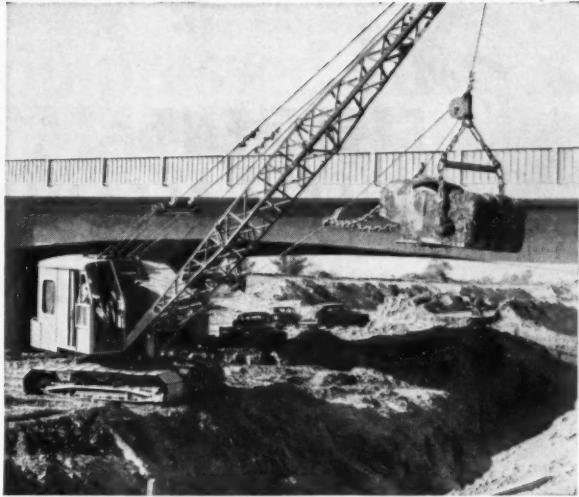
This LeTourneau-Westinghouse Tournapull is part of an earth-moving fleet used by the Lone Star Steel Company of Lone Star, Texas. The Company, one of the largest producers of steel in the Southwest, has been a consistent user of General Motors 2-cycle Diesel engines in several different kinds of earth-moving, construction and mining equipment for better than seven years.





SAVING \$170.00 A MONTH IN FUEL ALONE

United Construction Company cut fuel costs over 60% and reduced maintenance costs when they switched from gasoline to GM Diesel power on their Moretrench pumps. The GM Diesels worked 24 hours a day, 7 days a week—eliminated stops formerly required to pull and service spark plugs every three days and to replace them every three weeks.



13,000 HOURS—NO REPAIRS

General Contractor A. H. Famularo bought this GM Diesel-powered Northwest 25 Crane in April 1947. In 13,000 hours he never had an injector out, never touched the head or pan. He burns 16 gallons of low-cost Diesel fuel in 8 hours—specified GM Diesel power "because it was economical . . . and has proved to be reliable."



25% MORE WORK; FUEL COSTS $\frac{1}{3}$ LESS

Killough Construction Company has standardized on GM Diesel power for their portable rock crushing plant in Kansas. The firm uses six GM Diesels to run a hammer mill, operate conveyors and screens, a primary crusher and two shovels. One shovel, converted from gasoline to GM Diesel power, now does 25% more work on one-third less fuel cost.



"WONDERFUL PERFORMER"

This GM Diesel-powered scraper hauled nine yards every four minutes on a recent job for the R. J. Boe Construction Company. Contractor Russell Boe likes the "wonderful acceleration and trouble-free performance GM Diesel power gives me." He says, "All you need to do is keep water, oil and clean fuel in that GM Diesel and you'll get a good day's work out of it."

DETROIT DIESEL ENGINE DIVISION

GENERAL MOTORS • DETROIT 28, MICHIGAN

Single Engines . . . 30 to 300 H.P. • Multiple Units . . . Up to 893 H.P.

For
**EFFICIENT
BLAST CLEANING
at MINIMUM COST**



NORTON
BORON CARBIDE

Specify

**NORBIDE® Pressure
Blast Nozzles**

If you are descaling large areas like this storage tank, or cleaning small areas, you'll get maximum blast cleaning efficiency at minimum cost when you use NORBIDE® Pressure Blast Nozzles.

These nozzles — lined with the hardest material made by man — are available with bores ranging from $\frac{1}{8}$ " to $\frac{7}{8}$ ", with either flanged or threaded fittings. They are guaranteed for 1500 hours with steel shot or grit, or 750 hours with silica sand before the outlet enlarges more than one-half its original size.

This amazingly slow rate of wear helps conserve compressed air, reduces cleaning time and provides maximum efficiency from equipment and crew.

For full details on cost-cutting NORBIDE® Nozzles, write for your free copy of Form 543.

NORTON COMPANY
41 New Bond Street
WORCESTER 6, MASS.

NORBIDE® . . . The Longest Nozzle Life You Can Buy

ADV. 18
Circle 14A on reply card

Circle 15A on reply card

COMPRESSED AIR MAGAZINE

ON THE COVER

OUR cover picture is from an old colodion-coated glass negative displayed in January by the Chicago Historical Society to illustrate American photography from 1845-65, when only wet plates were available. The scene is of interest, too, because it shows part of the construction of one of our outstanding national buildings. The date, September 16, 1861, which appears on one of the stones, is evidence that the picture was taken when one of the present wings was being added to the Capitol.

Architects were invited in 1792 to submit plans for the building, and the winner of the competition was William Thornton. Construction was started in 1793 on a hill 88 feet higher than the Potomac River and President Washington laid the cornerstone on September 18 of that year. The structure, which had a low-domed rotunda flanked by wings for the House of Representatives and Senate, was not completed until 1827. Meanwhile, architects Stephen Hallet, B. H. Latrobe and Charles Bulfinch had modified Thornton's plans.

To provide additional room, two large wings were added in the period 1850-65, and the rotunda was heightened. Thomas U. Hunter was the architect. The cornerstone of the wings was laid in 1851 by President Fillmore, and Daniel Webster was the principal orator. The over-all length of the Capitol is 751 feet and the width ranges from 121 to 350 feet. The central dome rises 287 feet and is topped by a statue of Freedom by Thomas Crawford.

IN THIS ISSUE

IT IS a neat trick to build new piers for a half-mile-long railroad bridge on a main line and then move the superstructure without stopping traffic for more than 12 hours at a time. Our leading article tells how it was done.

FOR domestic and industrial cleaning purposes we Americans annually consume about 25 pounds of soaps and detergents per capita. If asked to name the best-known soap, most people would probably say "Ivory." An article beginning on page 68 was inspired by Ivory's seventy-fifth anniversary.

JOHNSON Western Constructors, of San Pedro, Calif., specializes in applying concrete with compressed air, a process commonly known as guniting, and is continually learning how to improve the operation. Page 72.

BIG pieces of machinery are the order of the day and we show four of them on pages 74-75.

SALES of self-contained breathing devices for use in hazardous atmospheres and for work and play underwater are mounting and creating a demand for high-pressure compressed air. Page 76.

OTHER articles deal with offices that travel with construction men by road, rail and water and with steel scrap of which American steelmakers consumed 23 million tons in 1954. Collecting it has emerged from the horse-and-wagon stage and is now big business.

Compressed Air Magazine

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VOLUME 60

March, 1955

NUMBER 3

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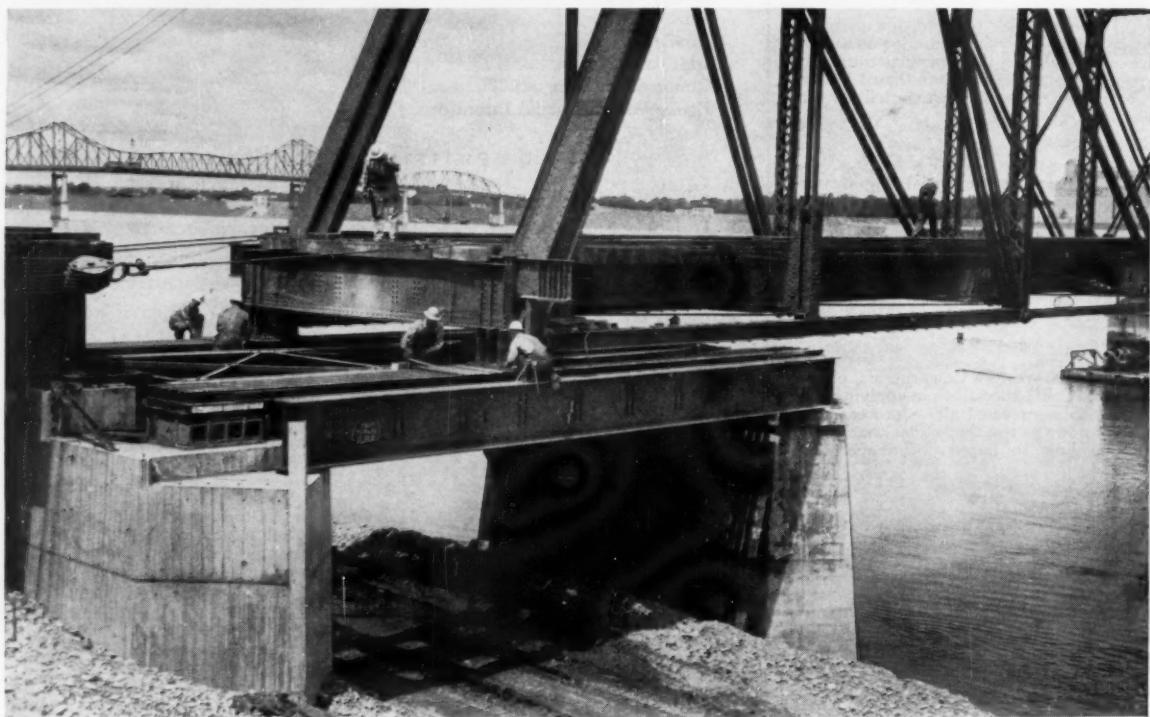
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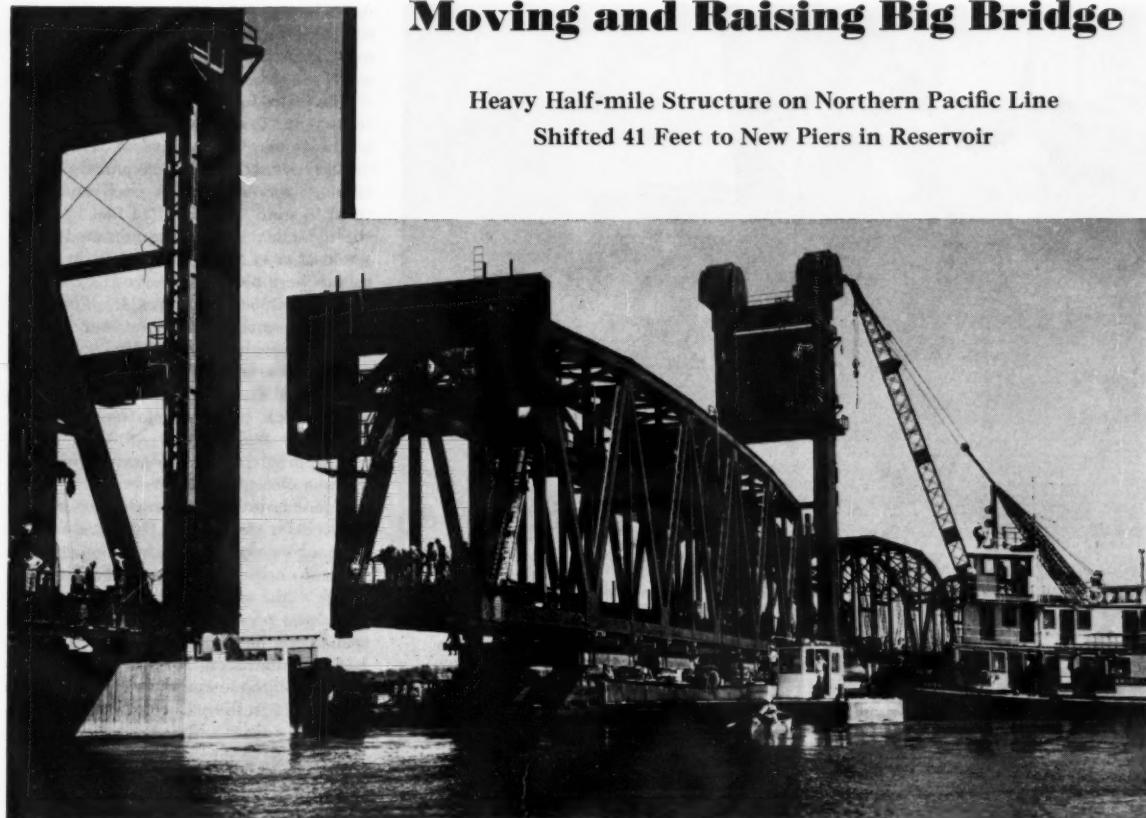
SHIFTING FIRST TRUSS

The top view shows a 40-foot-long girder span at the Kennett-wick side of the bridge being raised from its original position by a derrick car on the adjoining 250-foot, 500-ton truss span. Before the latter was shifted to the left to transfer the load from the old (right-hand) pier to the new one, the girder was carried across the truss and held in readiness temporarily to fill the gap at that point. The lower picture

shows the truss move about half completed. It was pulled by block and tackle across a temporary skid frame by means of 1-inch steel rollers under the shoes to reduce friction (detail picture at right). The bars were progressively transferred from the rear to the front as the structure traveled along. Similar provisions were made at the other end of the truss to facilitate the move.

Moving and Raising Big Bridge

Heavy Half-mile Structure on Northern Pacific Line
Shifted 41 Feet to New Piers in Reservoir



PLACING NEW LIFT SPAN

The old swing span was raised by dewatering pontoon barges stationed underneath it and then moved out of the way by tugs. The new 307-foot, 1100-ton lift span, waiting on a temporary trestle downstream, was lifted clear and shifted to its allotted place in a similar manner. Because of the close fit between its towers, it was first moved toward

the right between the legs of the tower, as shown, and then drawn back to the left by cables attached to a locomotive crane and carefully jockeyed into final position as the supporting barges were flooded to lower it. The bridge was closed to traffic for only twelve hours during this phase of the job.

ONE usually thinks of a bridge, especially one crossing a waterway as large as the Columbia River, as a fairly permanent and unchanging part of the landscape. But recently a massive $\frac{1}{2}$ -mile-long railway bridge was shifted 41 feet to new piers and then raised 4

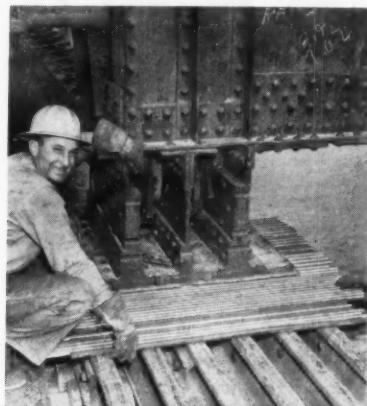
feet 2 inches above its old level by engineers of the Northern Pacific Railway, the Kansas City Bridge Company and the Massman Construction Company. What's more, the job was done without undue interference with train schedules; no small feat in itself because the bridge is one of the most important in the Northern Pacific system and carries on an average one train every 48 minutes. It spans the Columbia River between Pasco and Kennewick, Wash.

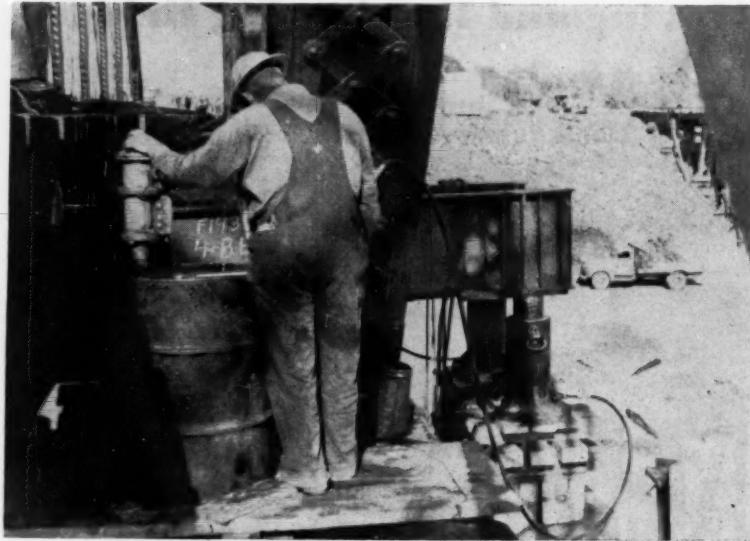
The bridge was built in 1888, and before it was opened to traffic trains were carried across the Columbia by ferry-boats. It consisted of nine spans each 250 feet long, a swing span of 237 feet and shorter iron-girder approach spans. In 1905 and '06, when railroads were beginning to haul heavier loads, the superstructure was reinforced, and that was the last major work of reconstruction until the building of McNary Dam some miles downstream which raised the normal water level at the bridge site 23 feet. Although it was not high enough to reach the deck, it did increase the buoyancy of

the piers and affected the stability of the structure. This, coupled with the possible harmful effects of ice, of the river in flood stage, and of heavy train traffic and braking stresses, made some program of strengthening mandatory.

Several plans were considered and ranged from building a new bridge to reconstructing the existing piers. Both were rejected—the first because of the cost and because the steel required was not then available, and the second because the large quantities of riprap around the concrete supports made it difficult to drive piling and to build cofferdams. Finally, because of numerous insurmountable obstacles, it was decided to construct new piers 41 feet away from the old ones but in line with the truss spans so that they could be shifted longitudinally. It was also planned to remove the swing span and replace it with a lift span of greater length.

The contract was awarded jointly to the Kansas City Bridge Company and the Massman Construction Company and work was started on May 12, 1952.





JACKING OPERATION

The workman has a hand on one of the air-powered pumps that forced hydraulic fluid from the drum on which it is resting into the jacks (right) that lifted each span 10 inches at each setting. As the structure rose, I-beam grillage was placed under the bearing shoes to hold it. Eight jacks were used on each span and the entire bridge was raised 50 inches. The grillwork blocking was left in place and later encased in concrete.

The stream bed at the site consists of 3 to 15 feet of sand and gravel overlying the Ringold formation having a maximum thickness of 93 feet. The latter is brittle, blue-gray and claylike but firm and nonplastic. As it could not be readily excavated with the usual clamshell buckets, air-operated clay diggers were brought into play. It was found that the material would stand in most places without sloughing or caving, thus making it possible to dig to the neat line of the pier footings and pour concrete without resorting to forms. In the sand and gravel, however, forms were used. The fixed-truss piers extended an average of 8 feet into the formation, while those for the lift span were carried 2 feet deeper.

By the original plan the eight fixed-truss piers were to be built in open cofferdams and the lift-span supports by the pneumatic-caisson method. The latter was specified because of the larger size of those piers which otherwise would have necessitated excavating dangerously close to the old footings. Air at 0.44 psi per foot of depth was used and called for precise control to keep the water out of the caissons and at the same time avoid excess pressure that would result in blowouts underneath the cutting edges, thus causing trouble by loosening and disturbing the river bed outside the enclosures.

The caissons were 36 feet wide, 73 feet long and provided a working space 7 feet high. They were of steel construction and designed so that a removable timber cofferdam could be attached to the sides.

While proceeding through the layer of sand and gravel the working chamber was quite wet, but once the cutting edges penetrated the Ringold formation excavation was in the dry. In fact, when the prescribed depth was reached, the floor was swept with a broom to remove all loose material.

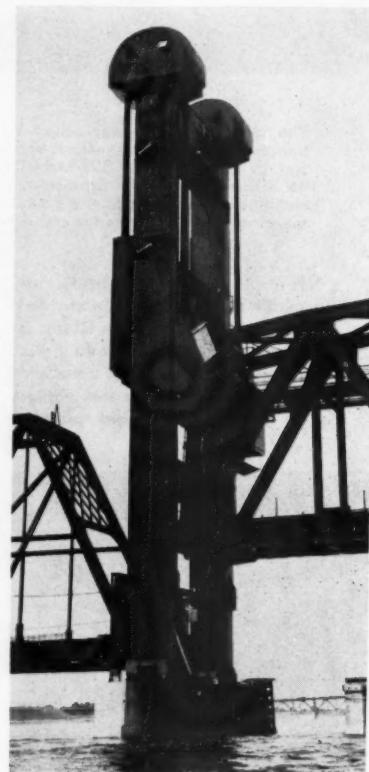
As operations progressed, difficulty was encountered in driving steel sheet piling through the sand and gravel for the open cofferdams and it was apparent that some other method would have to be used if the contract dead line was to be met. Accordingly, it was decided to build four more of the piers in pneumatic caissons. This change in plans increased the cost of the project to \$5,800,000, or by \$250,000, but the engineers are convinced the choice was a wise one for no further trouble was experienced and the substructure was completed several weeks ahead of schedule without seriously tying up train traffic and, obviously, without effecting the stability of the old piers.

On April 1, 1953, with the underpinning completed, work was started on the superstructure. This involved removal of the two girder approach spans—one 50 feet long and the other 40 feet—and shifting another 50-foot girder to a new location; transferring the nine 250-foot truss spans each weighing 500 tons to the new piers; replacing the swing span with the longer lift span; and raising nearly half a mile of bridge, plus the approaches, and grading the latter. It was necessary to do the entire job with as little delay to rail traffic as possible.

Actually, with the exception of the lift section, the bridge was closed at the most only three hours at a time and then when no trains were scheduled.

The procedure followed in moving the truss spans to the new piers was generally the same throughout. A temporary bridge structure, a so-called "skid frame," was erected at each end of a truss to span the gap of 41 feet between the old and the new supports. It consisted of steel girders with rails on which rollers were placed to move the truss by means of block and tackle. This preparatory work took from four to five days for each span. Then, after receiving clearance from the railroad dispatcher at Spokane, a locomotive crane and derrick car were stationed on the bridge.

The first truss to be transferred was the one closest to the Kennewick shore, and four hours of free track time was requested for this move. On schedule, the locomotive crane and derrick car were run out on the bridge on that side of the river. First the 40-foot girder approach span was removed, and then the block and tackle on the adjacent truss, which had been loosened from its footings, was coupled to the locomotive crane to begin the job of rolling the span to its new



LIFT SPAN PARTLY RAISED

A tower of the lift span at Pier 8 showing span guides and counterweights. The span is elevated partway.

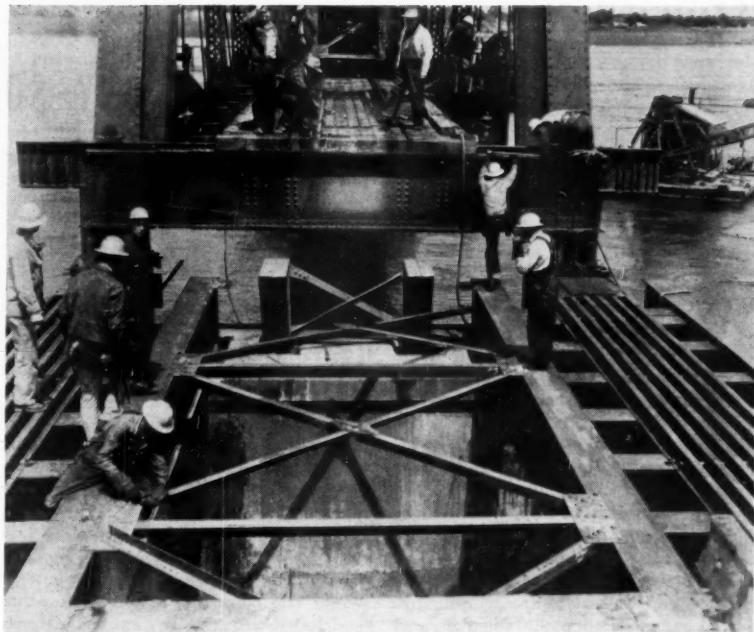
position by way of the skid frame. Men stationed on the latter "leapfrogged" the 1-inch hard-steel rods—picked up those coming out from under the truss and replaced them in front of it as it inched along. The ratio on the block and tackle was such that the span moved 1 foot for every 10 feet of crane travel. Actual relocation time was twenty minutes.

However, before proceeding with the transfer, the derrick car had hauled the 40-foot girder to the Pasco end of the truss where it would be handy to span the gap at that point temporarily and thereby open the bridge to rail traffic. The first move took only three hours, but later ones were made in as little as one hour and twenty minutes. And as soon as the operation was completed the skid frame was dismantled and reerected to repeat the performance.

Initially it was decided to remove the swing span and put the lift span in its place as soon as all the trusses had been shifted, but because of delays in the delivery of certain vital parts of the structure that plan had to be abandoned. Instead, the engineers began to raise as much of the bridge as possible so that grading of the approaches could be done while awaiting completion of the center span. Accordingly, the first three trusses on the Pasco side of the river and the shore end of the first span on the Kennewick side were jacked up the full height. The remaining trusses were then raised sufficiently to provide a gradual downward slope towards both ends of the swing span. This made the structure look saucerlike but did not affect train operations.

The 500-ton trusses were raised in 10-inch increments by the use of hydraulic jacks of 115 tons capacity, four at each end of a span. The full 10-inch lift was made in easy stages by jacking up first one corner of a span 1-1/2 inches and placing blocking under its bridge shoes and then raising the other one twice that distance in two lifts, and so on alternately in approximately 3-inch stages, taking care all the while that the blocking was well up under the shoes to prevent damage to the superstructure in the event of jack failure. The total raise of 4 feet and 2 inches was accomplished throughout without incident. Hydraulic power for the jacks was provided by pneumatic pumps which forced the fluid into them from open barrels and which were supplied with air by two 500-cfm portable compressors.

The 307-foot vertical lift span, weighing 1100 tons, was assembled on a temporary pile trestle that was erected on the downstream side of the bridge and connected with the contractors' construction rail spur at the Pasco end. In so far as possible, all machinery and traffic control devices were installed on it before emplacement to reduce traffic



ON NEW FOOTING

One end of Truss Span No. 10 shown after being seated on its new piers. The direction of the move was from the bottom to the top of the picture, and the rails on which the structure traveled may be seen at both sides. The gap in the foreground was filled by a girder (visible at extreme top-center) that was removed from the opposite end of the truss. It took only twenty minutes to relocate a span but from four to five days to get ready for the transfer.

delays to a minimum. Everything was so well organized that it took just one day—August 9, 1954—to remove the old span and to put the new one in place. That date fell on a Monday and was selected because it would cause the least interference with fruit trains moving eastward out of the Yakima Valley. Twelve hours of free track time were requested for the changeover, and the bridge was cleared for work at 5:15 A.M.

First the rails at the ends of the swing span and on the adjacent temporary girders were disconnected and then the girders were removed. In the meantime, four barges were flooded and spotted beneath the old span. When these were unwatered by pumping they served to lift the section clear of the center pin on the pivot pier. Next two large tugs pulled the barges with their load downstream to a nearby site where the structure was dismantled for use in building other bridges.

That done, the tugs were attached to four barges under the new span, which was similarly raised from its supports on the trestle and then maneuvered into position by the tugs. But before it was allowed to settle on the piers by flooding the barges, final adjustments were made by the aid of cables which were threaded through snatch blocks and attached to the span and to the locomotive crane and derrick car on the bridge. Shortly after

noon the structure was brought to rest on its bearings. By the time the tower-span girders were in place and rail connections made it was 5:15 P.M. Exactly twelve hours after it had been closed the bridge was opened to traffic, as scheduled.

An additional week was required to put the lift mechanism in operation and about two months more to raise the remaining six truss spans and the lift span to the specified elevation, as well as to embed the steel grillage or shoring in concrete. As a result of the removal of the old pivot and draw-span piers the bridge now provides a clear channel width of 290 feet, which is believed to be adequate for navigational needs in the foreseeable future.

J.E. Hoving (then assistant to the chief engineer and now assistant chief engineer at Seattle) supervised the entire project for the Northern Pacific Railway, with M.O. Woxland, assistant engineer, in charge of bridge construction. C.E. Ekberg, bridge engineer of St. Paul, Minn., reviewed and approved all bridge plans and dealt with all questions pertaining to construction and Harry Pyle was superintendent for the contractors. Howard, Needles, Tammen and Bergendoff acted as consulting engineers.

This article is based on a report prepared by J. E. Hoving

75 Years of Washing

SALUTE TO IVORY SOAP

Allen S. Park

WE ARE a little late in taking note of the seventy-fifth anniversary of Ivory soap. It fell in 1954, but we should nevertheless, mention it because the thing that makes Ivory distinctive is that it floats, and it floats because it contains myriads of tiny bubbles of air. We are sorry we can't say it is compressed air, for it really isn't under pressure when it is introduced. In fact, it isn't even blown in; instead, it is put in by mechanically paddling the heated soap mixture while it is a viscous mass. The action has the same effect as the whipping of boiled potatoes to make them creamy and fluffy. In the case of Ivory, the microscopic bubbles are imprisoned, and each of the individual cakes or bars to which the batch is later reduced is rendered light enough to float.

We inferred that every cake floats, but that is not entirely correct. The truth is that at least seven bars have been known to sink and cause somewhat of a stir in the head office of Procter & Gamble, the Cincinnati, Ohio, firm that makes Ivory. The first recorded instance of this kind occurred in March, 1943, at Bean Point,



N. Y. The next one, in September, 1944, got into the newspapers. During the following ten years five more cakes failed to uphold the slogan on their wrappers. The most recent sinking took place in New Orleans, La., last March, and the startled man who saw the soap submerge wrote the company a long letter that concluded with the prediction that anything could happen now, and even suggested that the search for Judge Crater, long missing New York jurist, be renewed.

Ivory wasn't always Ivory; it was first merely prosaic "white soap," and it wasn't always intended to float. Procter & Gamble, which started in business in 1837, selected the original name to distinguish the soap from the prevailing yellow laundry soaps of the period that got their color from rosin which was added to promote sudsing. Castile soap was white,

Imprisoned tiny bubbles of air keep the cakes afloat -- all but seven

but it was an imported luxury product beyond the financial reach of the masses.

The P & G white soap was made mostly from pure vegetable oils, and the firm featured this fact and its whiteness. Except for those two characteristics, it was physically like most other soaps, even to being heavier than water. Then, one day in 1879, the attendant of a "crutcher" or beating machine left it running during the lunch hour and the molten mixture was aerated. The cakes that were made from it floated.

It was purely an accident and almost "covered up." The foreman wanted to reboil the cakes that had gone awry, but somebody prevented that and ventured the opinion that consumers might possibly like a floating soap. It turned out that they did, because they began to write in and ask for more of it. There was a practical reason for this: most of the soap was sold in the Ohio and Mississippi valleys where domestic water was drawn directly from the rivers and was often highly discolored. In it, a sunken bar of soap couldn't be seen.

It seems that 1879 was a fertile year for new things. In the same month that Ivory soap made its appearance, Thomas A. Edison, who had once worked for Procter & Gamble and built for it a factory telegraph system, demonstrated the first successful incandescent lamp. The cash register was also devised in 1879, and the first Woolworth 5-and-10-cent store was opened in Utica, N. Y. Curiously, Edison's lamp dealt a lethal blow to one of P & G's leading products—candles. It was imperative that the company find another common household article to sell. Ivory was the answer.

The name Ivory was selected by Harry Procter, a son of one of the firm's founders and one of America's early genius salesmen. The word appears in the 45th Psalm, and Mr. Procter heard the minister read it in church one Sunday. It is understandable that the company should adopt a name that originated in a religious book, for it was always that sort of an organization. A bell in the factory rang loudly every Saturday at midnight as a signal to stop work until the Sabbath was over. And for 50 years most of the advertising for Ivory and other P & G products was published in church papers.

The first shipment of Ivory was made



SCULPTURE FROM SOAP

Ivory soap offers a convenient material for carving, and in 1927 the manufacturer inaugurated a national competition with cash prizes. Contests of various sorts have been a part of Ivory sales-promotion efforts since 1911.

in July, 1879. Previously having supplied large quantities of soap and candles to the Union Army, the firm had already learned how to gear its machinery to meet comparatively heavy demands, and before it introduced Ivory to the trade it was equipped to turn out 200,000 bars daily.

The first advertisement under the Ivory name appeared in *The Independent*, a weekly religious magazine, on December 22, 1882. It began: "The Ivory is a Laundry Soap with all the fine qualities of a choice toilet soap, and is 99 44/100% pure." Despite the fact that the art of selling merchandise through the printed word was then in its infancy, that initial ad, containing as it did a slogan and a definite selling idea, is listed among the hundred greatest advertisements so far produced in America. Once started, advertising never stopped. Harley Procter set out to make Ivory the best-known soap in the world and succeeded. He designed and patented the distinctive cake with notches in the middle to aid in cutting or breaking it. The

early ads showed how to do this with a piece of thread or fine string.

The phrase "99 44/100% pure" originally appeared in a routine report made by W. M. Habirshaw, a New York chemist to whom samples of the soap had been sent for analysis and comparison with castile, then the acknowledged standard of excellence. He found three harmless impurities present in percentages of 0.11, 0.28 and 0.17. He subtracted the total of 0.56 percent from 100. Harley Procter seized upon the resulting figure, and it became a fixture in Ivory publicity. The slogan "It Floats" didn't get into the ads, however, until 1891.

For Ivory advertising in 1882-83, the firm budgeted \$11,000, an unheard of sum in that era. Harley Procter was not content with less than full pages, which was an innovation. He was the first to employ well-known magazine illustrators to supply artwork for the advertisements. The idea was so new and the public reaction so unpredictable that some of the artists hesitated to sign their names.

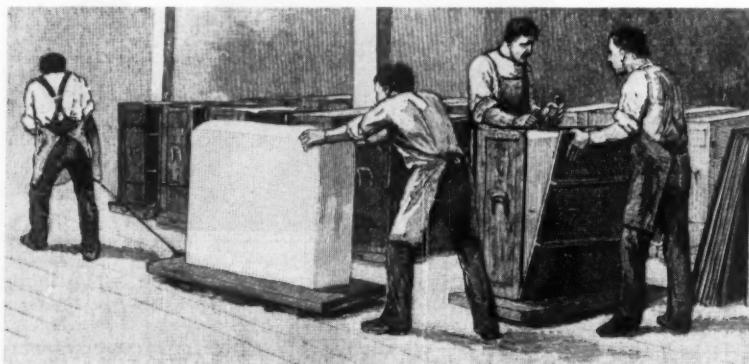
Ivory soap was originally cooked in

kettles until a veteran taster decided that it was ready to be run into the crutchers to be beaten and then into frames to harden for four or five days. The resulting 1000-pound cakes were cut with wires into slabs 2 inches thick, and the latter were reduced to bar-size pieces that were shaped and imprinted with the Ivory name.

Through the years the methods have changed, and Ivory is now made in mixing and cooling machines that resemble ice-cream processors. In the beginning, manufacturing was carried on in one factory at Cincinnati. In 1907, the year of a banking and financial panic, a second plant was added and called Port Ivory. There are now ten factories in the United States and Canada. In 1910 the bars were wrapped by machinery for the first time.

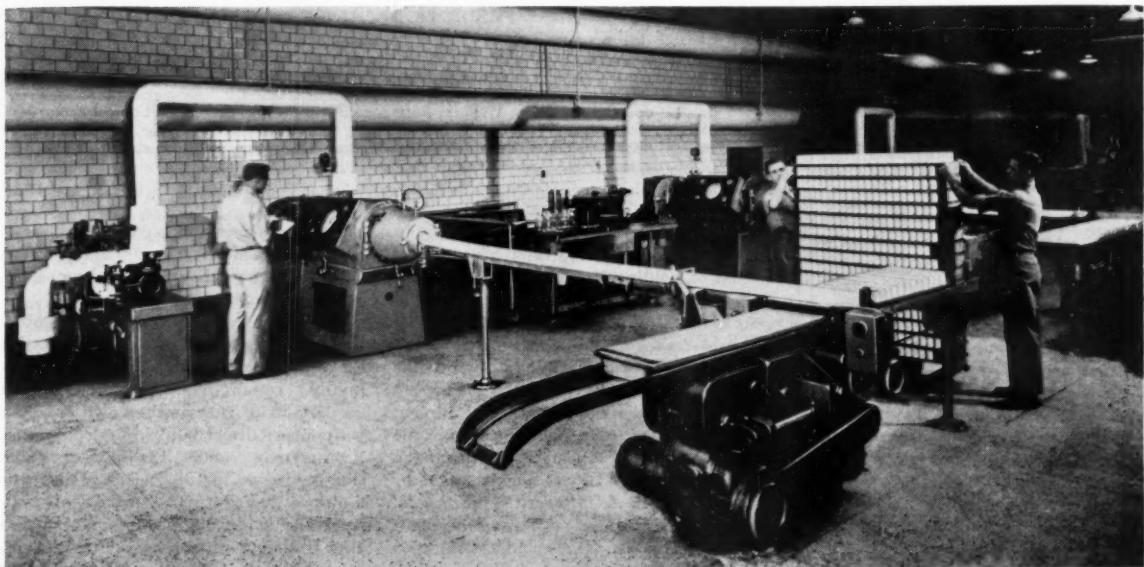
Motivated by the fact that some housewives had long been shaving bars of Ivory into chips for laundry use, the company brought out Ivory flakes in 1919. Ivory had always been made by a definite formula known to only a few persons, but in 1923 P & G began to "go scientific" by establishing a laboratory where hands, clothes and dishes were washed over and over with Ivory and various other soaps and the results carefully noted and acted upon with the idea of pleasing women.

A market research department was established in 1925 with the mission of sending representatives into homes to



CHANGING METHODS

For many years the soap was molded into 1000-pound cakes (left), which were later cut into slabs and then into bar size. It is now mixed and immediately cooled in a continuous strip of bar thickness (below).



question housewives as to their preferences among the varying P & G products. In 1927 the concern began promoting Ivory as a raw material for amateur and professional sculptors, and thousands of embryo artists in schools and homes carved the bars into untold shapes. An annual contest with cash prizes was inaugurated.

The first major improvements in the soap, some of them perceptible to the eye, were made in 1940. The objectives were to bring about faster sudsing or lathering; preserve the original white color of the bar (it had been yellowing with age) and its shape (it had a tendency to shrink when stored); improve its washing effectiveness; and develop a colored wrapper that would "seal in" the soap's good qualities.

In accomplishing some of these things the engineers hit upon a method of turning out bar soap continuously by pouring the hot product of the kettles on a cold,

THE "IVORY" is a Laundry Soap, with all the fine qualities of a choice Toilet Soap, and is **99 44/100 per cent. pure.**

Ladies will find this Soap especially adapted for washing lace, infants' clothing, silk hose, cleaning gloves, and all articles of fine texture and delicate color, and for the varied uses about the house that daily arise, requiring the use of soap that is above the ordinary in quality.

For the Bath, Toilet, or Nursery it is preferred to most of the Soaps sold for toilet use, being purer and much more pleasant and effective and possessing all the desirable properties of the finest unadulterated White Castile Soap. The Ivory Soap will "float."

The cakes are so shaped that they may be used entire for general purposes or divided with a strong thread (as illustrated) into two perfectly formed cakes, of convenient size for toilet use.

The price, compared to the quality and the size of the cakes, makes it the cheapest Soap for everybody for every want. TRY IT.

SOLD EVERYWHERE.

THE MANCOV

FIRST ADVERTISEMENT

Although it appeared 73 years ago in a religious weekly magazine, this advertisement is still included by advertising men among the hundred best produced to date in this country. It marked the initial appearance of the famous phrase, "99 44/100% pure."



DIRE PREDICTION THAT CAME TRUE

In 1928 the magazine "New Yorker" published this cartoon by Guy Williams under the heading, "Industrial Crises: the day a cake of soap sank at Procter and Gamble." It caused much merriment at P & G and framed copies were hung in many of its offices. In September, 1944, news was flashed to newspapers throughout the country that Mrs. William Porter, of Springfield, Mass., had bought a bar of Ivory that sank. The chagrined company scientists huddled over the bar for several days and concluded that it had become heavy through long storage. The company sent Mrs. Porter another cake—and it floated.

moving metal surface. This cooled it in a matter of seconds and eliminated the need of holding it in frames for several days. At the same time a way was found to reduce the moisture content by one-third. As a result of these advances all the factory processing equipment was replaced.

Through such continual watchfulness, modernization and salesmanship, the price of Ivory has been kept from rising greatly. In 1951, R. R. Deupree, chairman of the P & G board of directors, said: "With wages and taxes equivalent to 40 times the wages and taxes of 65 years ago, with raw material prices three

times what they were, a cake of soap that cost 5 cents in 1885 costs less than 10 cents today and the quality is immeasurably improved."

Procter & Gamble was a family enterprise until its incorporation in 1893. Its sales now total around \$800 million annually. It employs 23,000 people, and 95 percent of them either own stock in the concern directly or through company profit-sharing plans, the first of which was instituted in 1887. P & G also was a pioneer in granting Saturday half holidays and some other employee benefits that are now common in American industry.

ONE of the hottest and wettest rock tunneling jobs on record is nearing completion in California after nearly four years of unremitting combat with conditions that have frequently approached the intolerable. At one stage the work was shut down for several months while those in charge pondered on whether it was feasible and practicable to continue. One means of coping with the heat and humidity was to ride the men to and from the heading in cars filled with cool water.

The tunnel is the Tecolote, a 6.4-mile bore through the Santa Ynez mountain range. It is a major structure in the U.S. Bureau of Reclamation's Cachuma Project, which is designed to divert water from the erratic-flowing Santa Ynez River to the city of Santa Barbara and adjoining parts of a narrow coastal strip of agricultural land. Even the water that impeded the progress was welcomed by the farmers for irrigation purposes. At one time a sizable inflow coincided with a severe drought in Santa Barbara and the Montecito district and served to lift restrictions that had been imposed on the use of water.

The maximum inflow was 9200 gpm, and the highest temperature 117°F with 100 percent humidity. A 200-hp blower at the portal and a booster inside forced 5000 cfm of air to the working face. In addition, the compressed air that operated rock drills and other equipment had a cooling effect as it expanded through exhaust ports. To increase this as much as possible, several 6-inch centrifugal pumps driven by air motors were installed last May to handle an inflow that reached a temperature of 112°. The exhaust air from the motors was introduced into the main ventilating duct and carried to the heading. E.R. Crocker, project manager for the Bureau of Reclamation, stated in a paper delivered before the annual convention of the American Society of Civil Engineers at San Diego, Calif., on February 10 that "this use of compressed air was perhaps the one factor responsible for the successful completion of the tunnel."

Most of the trouble was experienced in the section of the bore advanced from the downstream portal. A 14,919-foot stretch driven from the inlet or upstream end at Cachuma Dam was finished many months ago and the job of lining it with concrete was concluded in January, 1954. At the time the final report on working conditions was made the inflow was only 200 gpm and the temperature 78°.

Tunneling from the lower portal was started on May 3, 1950, by Halvorson Constructors, low bidder at \$4,750,455 for the entire project. The bore is of horseshoe cross section and only 7 feet 9 inches wide, and congestion was caused by the pipes that had to be laid to dispose of the water and that had not been counted on. Crowded into the narrow

Hot Tunnel Troubles Men's Souls

space were the tracks of the haulage railroad, a 14-inch ventilation duct, one 14-inch and two 12-inch water mains, two 6-inch air lines and three power cables. The tightest squeeze was where double tracks were provided for passing. There all utilities were carried overhead and riders had to duck when going through.

A fairly heavy flow of water was struck in the spring of 1951, but serious trouble was not experienced until August. The volume increased markedly, and the temperature in the bore, which had been inching up, reached 87°. At that time the heading was in 11,250 feet, and progress on the next 250 feet was very slow. In September and October this stretch was lined with concrete and the flow thereby reduced. Late in the year it mounted to 3500 gpm and continued at that rate for three months. Grouting was resorted to frequently, but the only effect it seemed to have was to drive the water ahead where it was again encountered later.

In February, 1953, the influx subsided somewhat and then became irregular. Although progress was still hampered by the frequent need of grouting, an average monthly advance of 340 feet was maintained for four months. In June, however, conditions grew so bad that only 80 feet was driven. Grouting necessitated the use of 1028 sacks of cement at one place and 2981 sacks at another. The inflow reached 3600 gpm and the air temperature 112°. Then, by agreement of the Bureau of Reclamation and the contractor, the job was shut down to study the situation. Late in the year a 3-man board of experienced engineers was retained to survey conditions and to render advice. Upon receipt of its report, plans were made to resume work.

At the suggestion of Halvorson Constructors, the remainder of the job was subcontracted to the firms of Coker Construction Company and Peter Kiewit Sons' Company and changes in the original contract were negotiated. The cost of some items was lowered, but the unit price for excavation was increased tenfold—from \$44 per cubic yard to \$447. The net result of this was to add \$4,176,360 to the total outlay, thus

bringing it close to \$10 million. From January until April, 1954, the new contractors were at work rehabilitating the tunnel and equipment and resumed driving on April 12.

Ironically, the previous job of General Superintendent Ray Blasongame, Project Engineer Don R. McGregor and several other key men had been the Eklutna Tunnel in Alaska. It was Blasongame who got the idea of transporting the men to and from the heading area in "portable bathtubs." One day last spring the muck car in which he was riding stopped directly under a gushing stream of fairly cool water. It felt so good that he had drain holes plugged in several cars so that they would hold water. At first they were filled with water from the tunnel but later a cooler supply was obtained from outside.

The heat was worst between the 250-foot concrete section and the drilling face. So that electrical equipment would not raise the temperature in the heading, a pump room was established by enlarging a 60-foot length of the lined stretch to a diameter of 17 feet. The room contained transformers for a 2300-volt power line, a motor-driven booster on the ventilation line and five motor-driven pumps. Because the tunnel sloped very gently from the heading, gravity flow would not drain it fast enough, so the water was pumped back to a sump at the pump room by the air motor-driven units up ahead and then to the portal by the electric pumps.

The pump station was a normal stop for all man-trips, and there the transfer was made to and from the water-filled cars. Several of the latter were always stationed at the heading so the tunnelers could cool off in them whenever they had a rest period. Because of the difficult working conditions fifteen men were used per shift where nine would suffice in a dry bore. Most of the workers were under 40 years of age, and all were given a complete physical examination before being accepted for duty.

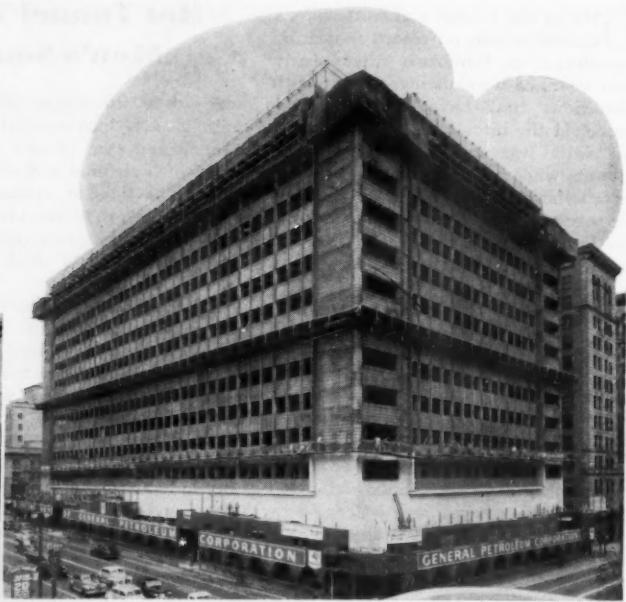
Aside from making the place uncomfortable for the men, the water, which is liberally laden with sulphur, attacked all ferrous metal surfaces causing them to rust quickly. It also affected the controls on all the electrical equipment and made regular maintenance necessary. It was especially difficult to take proper care of the locomotives (five on hand, four in service at a time) which ran through water up to 2 feet deep.

The hot springs that found their way into the tunnel are no doubt associated with igneous rock intrusions in the district. It is reported that there are signs of an extinct volcano in the mountains. A Santa Barbara newspaper of 75 years ago published an article on it and stated that "the earth about its crater-like opening is warm, and heated gases hiss and break through the rifted sod."



Air to Spare

PORABLE COMPRESSORS SPEED GUNTING



THE history of man's construction projects is largely the history of concrete in one form or another. With the development of Portland cement in 1845 the adaptable building material became, and has remained, king of the construction industry. Today's concrete is much stronger than that used 100 years ago, or even 25 years ago for that matter, and the change is not attributable alone to refinements in the basic material. Mixing and placing techniques also have played a vital part in the making of better mortar and concrete.

Guniting, a process by which concrete or mortar is mixed and applied in one operation, has increased steadily in importance since it was developed in the early 1900's, and for the last fifteen years it has ranked high on the list of construction methods. Basically, Gunite is pneumatically placed concrete—aggregate and Portland cement conveyed by compressed air to a "gun" where water is added and the hydrated mixture blown into position. The advantages of the technique are readily apparent and make it applicable to almost all types of structures, particularly where an extremely dense material impervious to water is needed.

The growing use of Gunite has been due in part to improvements in portable air compressors, upon which the process depends. Recent developments in the latter field have proved that fact, and the experience of one firm with Ingersoll-Rand Gyro-Flo rotary compressors should be of interest. Johnson Western Constructors, of San Pedro, Calif., has

had a hand in many western projects, and for the past twenty years its Gunite Division has been one of the country's foremost contractors employing that technique. For example, it completed a 1-million-gallon water storage reservoir of Gunite for the City of Monterey Park, Calif.; gunited the walls of the new limit-height General Petroleum Building in Los Angeles and a 110-foot-high tower at Loyola University; and applied the

VARIED APPLICATIONS

Gunite is readily adaptable to different types of construction. By spraying a 4-inch shell directly against earth walls and floors it is possible to build swimming pools—even odd-shaped ones—economically. Johnson Western has constructed approximately 4000 gunited pools in California. More than 4000 cubic yards of lightweight-aggregate Gunite was applied to the structural-steel members and interior partition walls of the 13-story General Petroleum Corporation building in downtown Los Angeles (top-right). A bank of the San Gabriel River was protected along a 4-mile stretch with a 3-inch coat of Gunite (above). Three Gyro-Flo compressors were used to complete the operation before the rainy season set in.

method in renovating the Blessed Sacrament Church in Hollywood with its 200-foot steeple. (Although the jobs listed are all in southern California, the company also operates from branch offices located in Oakland, Bakersfield and Fresno, Calif.)

Johnson Western is now in the midst of a program of complete conversion to Gyro-Flo 600-cfm rotary compressors. Needless to say, there are good reasons



REHABILITATING A HIGH SCHOOL

Although it is a brick structure, Roosevelt High School in East Los Angeles was not originally built to withstand earthquake shocks, so it was recently strengthened. The outer brick facing was removed and 5 inches of Gunite applied. In addition, horizontal and vertical grooves were cut into the backup brick, and channel steel was placed to provide a column-and-beam network, which was then faced with from 9 to 15 inches of Gunite. The exterior section shown below, with a Gyro-Flo compressor on duty, is finished and ready for removal of the scaffolding. Classroom partition walls were given a 7-inch curtain of Gunite (left) and then a finish plaster coat.



behind the decision to change a major part of its capital equipment. The firm's engineers call those reasons—economy and efficiency—"the twins." From the standpoint of efficiency, the capacity of this portable unit is the most important factor.

Guniting specifications laid down by the Gunite Contractors Association now require a minimum of 365 cubic feet of free air per minute and 45 psi pressure in the gun chamber both for placement and for rebound blowout (removal of Gunite which has bounced away from the point of application). Because the gun may be a long distance away from the compressor there are many instances where a 500-cfm machine might be strained to the utmost. As Johnson Western engineers expressed it:

"In the old days maybe 350 cfm would have been enough for Gunite work but even then pressure might have been low. Then compressors went to 450 cfm and that seemed to do the trick for a while. And then for ten years we used the 500 cubic foot units. Finally, a few years back, we bought one of the first I-R 600's for work in California. . . . A great deal of our work still could have been handled by the old 500's, but the advantages of having that extra 100 cfm on any machine wherever it might be called upon for use is an operational efficiency factor we couldn't ignore."

After experimenting with the early model, the engineers found they could "shoot" 30 to 40 more sacks of cement per day than with a 500-cfm unit, the added capacity making it possible to place 20 percent more Gunite than previously. One of the first jobs for the Gyro-Flo was the San Gabriel Mission High School, San Gabriel, Calif. In excess of 2000 cubic yards of Gunite went into that structure, the largest single gunited building in the southern California area.

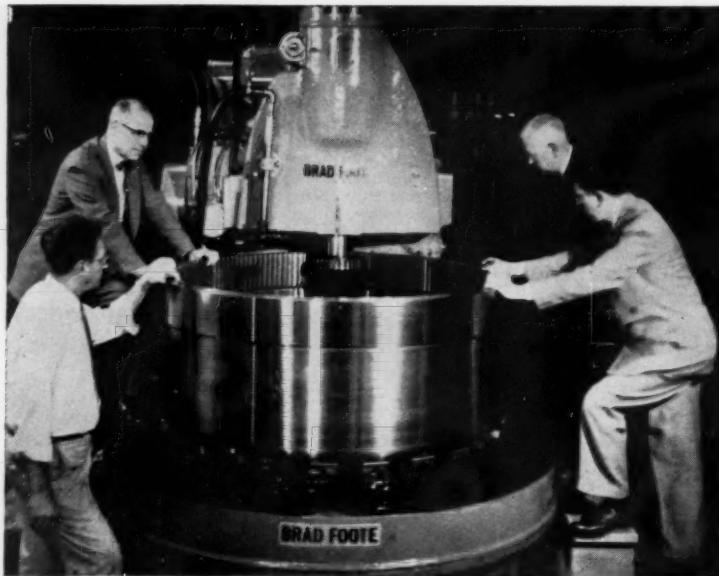
The increased production obtainable by use of the new portable has also proved invaluable in working on canals and other irrigation projects where speed is often instrumental in making a job show up in the profit column. The extra 100 cubic feet of air at full pressure means greater range, too. In the cases of the Loyola University and Blessed Sacrament towers the compressor supplied air at enough pressure and volume to shoot the Gunite to those heights and do the work right.

The economy factor, however, was equally important in "selling" Johnson Western on the larger-capacity machine and hinges on its new design. First of all, the Gyro-Flo is compact; it can be mounted easily on a truck, thus conserving its tractive force for towing the guniting equipment to construction sites. Besides reducing the number of haulage units needed for this purpose, truck mounting gives the Johnson Western fleet of compressors increased mobility, according to the operators. But the clincher, so far as management was concerned, was the rotary machine's greater service availability. It has fewer parts to wear or get out of "whack," and the company figures on about 11,000 hours of trouble-free use, which is equivalent to

four years of operation without repairs.

Gunite has long been a favorite building material for reservoirs, irrigation canals and swimming pools. In fact, it is frequently preferred for the latter because it permits giving them odd shapes such as a grand piano, indicating the profession of the owner. But Gunite is also invaluable in other fields of construction. More and more buildings have Gunite walls, and badly flaked or broken concrete can be made as good as or better than new by applying a thin layer of the material. It also lends itself well to the prestressed-concrete method of construction. For many years buildings have been made fireproof by coating structural steel with Gunite, and more recently steel pilings so protected have come into wide use.

The "Cement Gun" process of concrete placement seems to be slated for far more general application than ever before, and Johnson Western, with its skilled operators, engineers and research men will undoubtedly play an important role in the business in the West. Good equipment, with plenty of reserve power when it is needed, has been and will continue to be instrumental in the growth of guniting and of Johnson Western Constructors.



KING-SIZE COUPLING

Officials examining a 4000-pound coupling designed for use on a shaft that will drive a fan in a wind tunnel for testing jet aircraft.



SHOVEL DWARFS TRUCK

A Marion power shovel that takes 7-yard bites shown in service at the site of a \$34-million hydroelectric dam under construction at Roanoke Rapids, N.C. It carries an Ingersoll-Rand compressor to supply air power for the brakes. The shovel and eight 22-ton Euclid trucks are helping to excavate one million cubic yards of rock from the tailrace.

Machinery Is Getting Bigger

NOWADAYS large machines are fairly commonplace but still of interest, and several recent examples have attracted attention.

- At Cleveland, Ohio, Aluminum Company of America has placed in service a 4,000,000-pound press that can apply 8000 tons pressure for forging metal. Designed and built by United Engineering & Foundry Company, it was supplied to the firm under a lease agreement with the U.S. Air Force and will be used primarily for making vital aircraft forgings. It has an over-all height of 55 feet, of which 38 feet is above floor level, a die area 11½ feet long and 4½ feet wide, and a working stroke of 6 feet with a 3-inch-per-second pressing speed. The controls can be moved to any vantage point the operator considers best. Hydraulic fluid to power the unit is furnished by three 700-hp pumps and stored in a 600-gallon accumulator at 4500 psi pressure.

Despite its hugeness, the machine is not the largest one in the Cleveland plant, which has one of 15,000 tons capacity, as well as a 3000- and a 1500-ton unit. Furthermore, two superpresses of 35,000 and 50,000 tons capacity are to be added sometime this spring. The 8000-ton machine was needed to handle work of intermediate sizes. In addition to shaping aluminum pieces, it will be used to forge magnesium and titanium products. In the field of civilian goods it is suitable for forming such things as automobile and truck wheels.

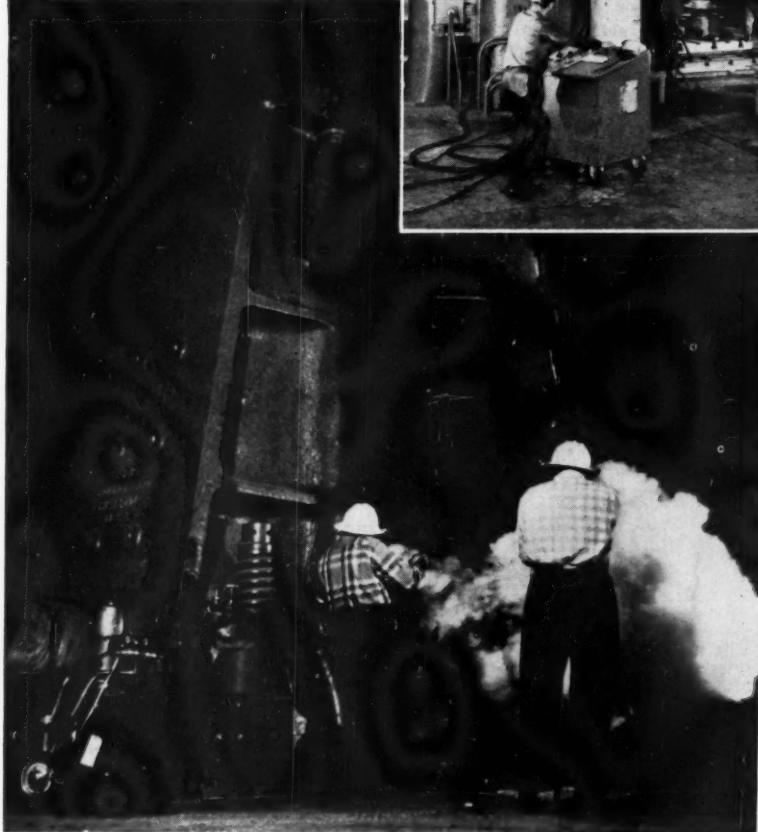
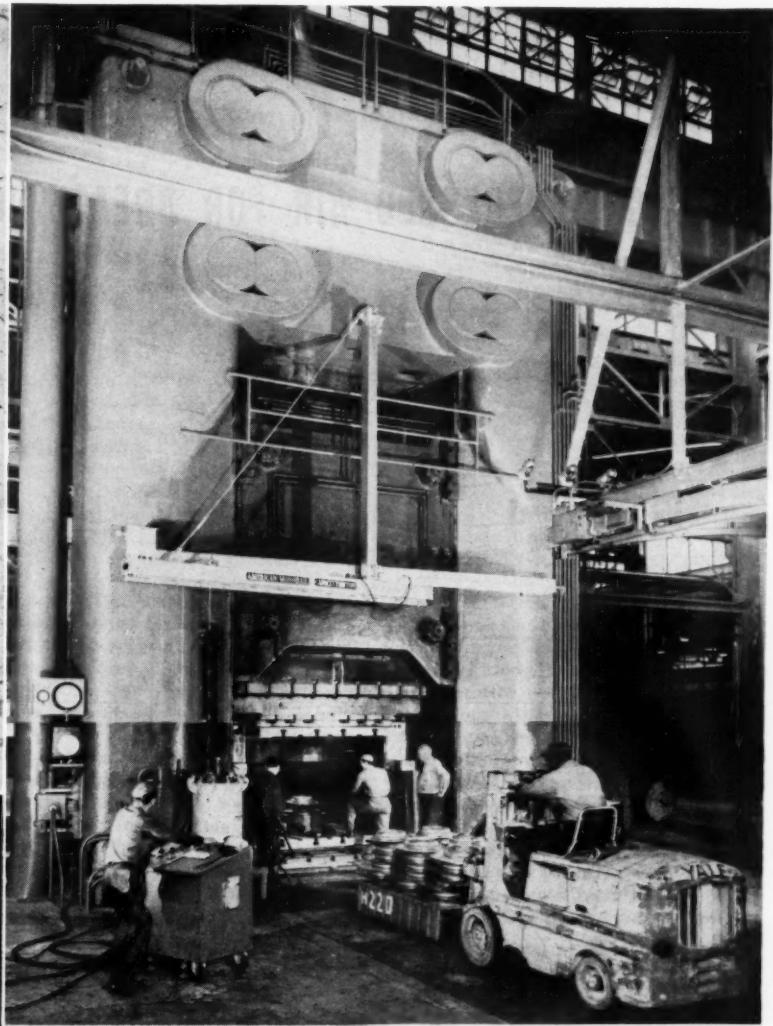
Most hydraulic presses are held together by several threaded tie rods that act like giant bolts to prevent the machine from pushing itself apart when pressure is applied to the dies. This one, however, has no such rods but is composed of a group of castings (up to 400,000 pounds each) joined by unique shrink links that were made as follows: rings were heated and fitted over lugs on each casting. As the former cooled they contracted, holding the parts together firmly. This rigidity permits guiding the forging dies with extreme accuracy and working to close tolerances.

- Among the machinery for a new \$6,000,000 shop built by the Kropp Forge Company, of Chicago, Ill., are two Erie 50,000-pound drop hammers that are said to be the biggest of their kind and enable the concern to produce correspondingly larger and more complex forgings for military-aircraft components. Each one weighs close to 2,000,000 pounds and rests on a 6,500,000-pound block of reinforced concrete that has a surface area of 42x36 feet and extends 23½ feet into the earth.

Auxiliary equipment includes two 2750-ton presses, six newly designed lithium-atmospheric controlled furnaces and a hydraulic forging press. The furnaces make it possible to turn out forgings with no scale, pit marks or oxidized surfaces and consequently so close to the finished dimensions prescribed that little subsequent machining is necessary.

- At Coatesville, Pa., the Lukens Steel Company recently unveiled a press that can straighten steel plates weighing more than 50 tons each. It weighs 1,500,000 pounds, has a movable head that can exert a pressure of 5000 tons, is as high as a 2-story building and occupies 400 square feet of floor space. It was built by the Clearing Machine Corporation, of Chicago, and is unrivaled as to size.

The machine will be used mainly for straightening armor plate for U.S. Navy ships prior to its delivery to shipyards, and less frequently for general commercial work. It is operated by hydraulic power and controlled electrically by one man. The controls are said to be so sensitive that a slab of steel 14 feet long, 50 inches wide and 20 inches thick can be straightened to within ½ inch of a perfect line. The pressing head can be moved from right to left as much as 160 inches. In addition there are two motorized cars, one on each side of the unit, that can shift a steel plate backward and forward so that it can be flattened anywhere throughout its area.



FOUR-STORY PRESS

A 38-foot-high forging press that weighs 2000 tons and exerts 8000 tons pressure for forming aircraft parts.

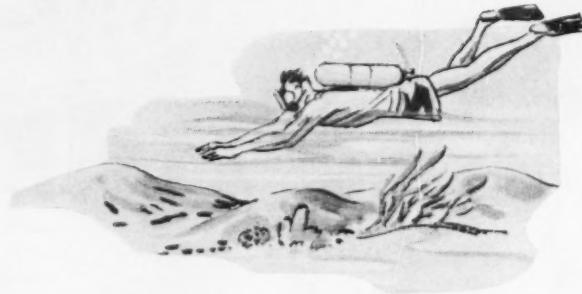
• Brad Foote Gear Works, Inc., of Chicago, has just completed a 4000-pound coupling for use in a wind tunnel at Tullahoma, Tenn., where jet aircraft are tested under simulated flight conditions. It also is claimed to be the largest ever made. It has an outside diameter of 58 inches, a length of 24 inches and is to be installed on the main drive shaft of a fan that will revolve at 600 rpm to produce a maximum wind velocity of 3000 miles per hour. At full speed it will develop 216,000 hp. The company produced the coupling on a 100-inch Fellows gear shaper of its own design.

GIANT HAMMER

One of Kropp Forge Company's two 50,000-pound drop forge hammers. It weighs nearly 1000 tons.

The Aqualung and the Air-Pak have created a flourishing new business of

SELLING COMPRESSED AIR FOR BREATHING



DIVING by use of self-contained breathing apparatus—sometimes for business but more often for sport—has spread rapidly both here and abroad since we first dealt with the subject.* Manufacturers of the equipment used for the purpose have been certain right along that the demand for it would be even greater if compressed air at the requisite 2000-psi pressure were readily available at convenient locations. We are now informed that sources of supply have been established in most major cities in the United States, both along the coasts and inland waters; in fact,

Scott Aviation Company, of Lancaster, N.Y., maker of several types of such breathing apparatus, has compiled a list of its distributors and customers who have installed facilities for recharging cylinders and who provide the service on a commercial basis.

Our first article pointed out that the supply of air for diving rigs was limited by the number of compressors upon which they could draw. It was suggested that the best way to meet the need for 2000-psi air would be for individuals to form clubs and jointly purchase a machine. This has been done in many cases, but in other areas a problem arose similar to the old poser, "Which

AIR FED FROM A STATIONARY CYLINDER

The workman shown is wearing an 11-pound Air-Pak supplied with air through a hose line connected to a cylinder containing 300 cubic feet at 2400 psi pressure. It will sustain him for from five to eight hours under extreme exertion. Much of the air in these cylinders that is sold is supplied by the Medical Division of the National Cylinder Gas Company. It is compressed in that firm's oxygen-producing plants by the same machines that put air under pressure prior to liquefying it in order to separate the oxygen.

comes first; the chicken or the egg?" Without a source of air it was not possible to find enough enthusiasts to promote an organization, and without the club few persons were willing to invest in a dependable compressor.

Scott Aviation has manufactured a self-contained breathing device for many years, and even before its introduction was making demand-type regulators for our Air Force. The Air-Pak, as the former is known, replaced certain types of canister and oxygen breathing apparatus because it affords added safety—presents no hazard in explosive atmospheres as do oxygen devices—and starts without the need of waiting for chemical reactions. Furthermore, it can be put to work without warm-up in temperatures as low as minus 20°F. Cost per use is low, which is of advantage when training men to handle the equipment.

Air-Paks have a wide field of application, including municipal fire and rescue departments and plant-maintenance and safety groups, particularly in the chemical and petroleum industries. For that reason a sizable number of Scott distributors own compressors to recharge the tanks, and many customers have their own facilities. Others have arrangements with National Cylinder Gas Com-

*"Compressed Air Under the Waves," page 221, August 1953



IN A GASEOUS ATMOSPHERE

Scott Air-Paks were devised to protect workmen subjected to impure or hazardous atmospheres. More recently a similar apparatus was developed for underwater breathing and is known as the Hydro-Pak. In the operation pictured, Air-Paks are being worn by members of a crew drilling a well from which natural gas is escaping.

pany to furnish large commercial flasks of high-pressure air from which the small portable units can be filled by the cascade method.

More recently the Air-Pak was adapted for underwater service, and the new apparatus is called the Hydro-Pak. This brought about an increase in the demand for air and induced distributors' shops to accelerate the installation of compressors and made it apparent to private firms that part of the cost of their own recharging equipment could be repaid by offering the service on a commercial basis. By means of a simple adapter it is possible for them to recharge Aqualung and other cylinders, as well.

The air from these sources meets the U.S. Bureau of Mines standards; that is, it is free from objectionable odors and contains about 20.9 percent of oxygen and not more than 0.005 percent or 50 parts per million of carbon monoxide (CO). Although the latter figure sounds formidable, it is not too hard to attain in practice provided certain precautions are taken.

In general, there are but two ways in which CO can get into compressed air supplied for breathing purposes. On the one hand, it may be in the air prior to



compression. That may be the case when the compressor intake is located too close to the exhaust of an internal-combustion engine, thus literally flooding the air with the deadly poison. This, fortunately, is a rare occurrence, for it is easily overcome by placing the intake where there is a plentiful supply of fresh air.

The cylinders of oil-lubricated compressors are the second and most common cause of the noxious gas. If they are overheated, either through improper design or cooling, the lubricant may vaporize and some may burn to form carbon monoxide. The first remedy that comes to mind is to substitute water or graphite for the oil, and that is what some large commercial suppliers do.

If an oil-lubricated machine is used properly, however, there is no danger of excess CO in the discharge. This means of course that the compressor has to be run as recommended by the maker. As an added safeguard an activated filter with silica gel, charcoal, etc., should be used. When combined with effective aftercooling to condense and remove water and oil vapor, safe breathing air can be obtained. These few simple precautions are no harder to follow than those prescribed for diving and will insure a safe trip into the fantastic world beneath the surface of the sea.

Several other sources of high-pressure breathing air besides those upon which Scott Aviation distributors and customers depend have come to our attention. The development and growth of these suppliers may be of interest as a pattern for the opening of new markets and the promotion of free diving both for industrial and sports purposes. These operators generally started out by installing cascading equipment and buying air from concerns in the oxygen and acetylene business. In that way they avoided making the initial high investment in a compressor plant. But because cascading is the more expensive method of filling the tanks owing to a certain amount of waste and to the cost of hauling commercial cylinders to their establishments they had to charge more for the service.

The cost of a single tank of air for a diving rig varies from place to place throughout the country, but it generally

runs a little in excess of \$2 for cascaded air and anywhere from 5 to 25 percent lower if furnished by a small compressor. But even at the premium price free diving is not so expensive an avocation or sport as are many others. A single charge is sufficient for about 45 to 60 minutes of swimming at average depth, and many individuals took advantage of the service. Then, after the demand had grown to a point which indicated that the capital outlay could be amortized within a reasonable length of time, the independent operators installed compressors. On the other hand, if they found that the business in their area would not support such equipment they were able to avoid a possible capital loss.

There is one other entry on the negative side of the ledger for the prospective retailer of breathing air and that is that free diving is largely a seasonal sport. In the northern part of the United States the climate permits underwater swimming only for a period of about three months without the use of protective rubber suits. In the South, the season may be but five or six months long even though it is quite warm there the year round. That is because cold water currents tend to cool the semitropical sea.

Thus it can be seen that the decision to invest in a piece of equipment that would at best be providing revenue only during half the year is a weighty one. A look at the sales figures of the makers of free-diving rigs, however, shows that a good many people are betting on being able to get the air they want. And a reliable compressor plant, capable of doing all the recharging in a medium-sized resort area costs no more than other pieces of vacation-time paraphernalia that lies idle most of the year. Anyway, compressed air has been applied to another of man's needs and one that is growing and will require more and more capital investment in equipment.



"Poor Hank never learned to swim"



IN A CHEMICAL PLANT

The tank this man is carrying holds enough air to supply him for 30 minutes of heavy breathing. The amount delivered to the wearer corresponds exactly to his inhalations, regardless of age or physical condition.

Mobile Construction Field Offices



SUPERVISION AFLOAT

A Merritt-Chapman & Scott barge (right) at the site of the New York Thruway bridge across the Hudson River above New York City. The interior view (above) shows Burton F. Sanders, project manager, with his secretary.

PORTABLE headquarters on construction jobs are gaining favor. Automobile trailers with special office interiors are becoming rather common, especially on highway-building operations. Railroad cars and floating barges also have been adapted for the same purpose. Until recently, about the only users of mobile industrial offices and shops were railroads. Section crews have long been based on made-over boxcars, and presidents of rail lines have traditionally had private cars in which they might live and work while they traveled.

When a contractor moved onto a new job a few years ago, typical procedure was to rent an existing building or several rooms in one or put up one or more structures. In either case it wasn't possible to get going in earnest until the quarters were equipped, and even then the facilities often left much to be desired. The same annoying and delaying program of getting established had to be repeated on each contract. In contrast, many firms nowadays transport a complete office to the work site, and the staff is ready to function almost within minutes after arrival. Moreover, the facilities are adequate and comfortable. And when a project has been completed,

it is necessary only to disconnect utility lines and move to the next location.

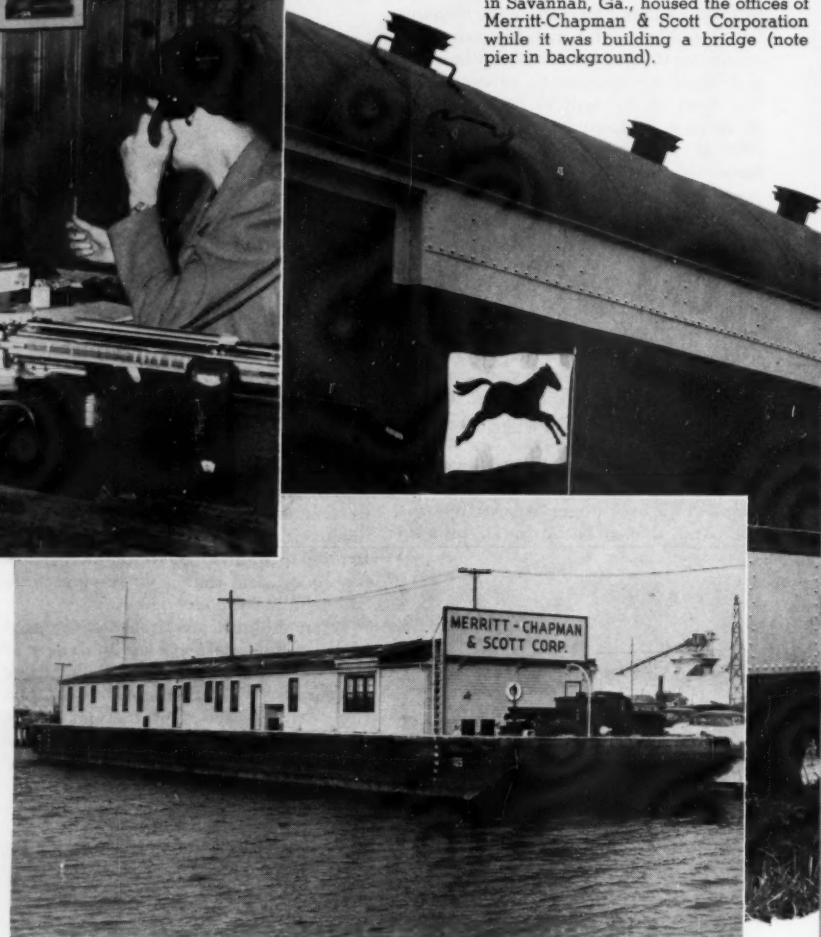
Merritt-Chapman & Scott Corporation, of New York City, has carried this idea farther than most construction concerns and now utilizes both Pullman cars and floating barges. The latter were commissioned first—largely through necessity. Some five years ago when the company set out to erect a bridge at Washington, D.C., the project manager, William Denny, who is now executive vice-president, couldn't find suitable offices on shore or a convenient site on which to build some. He solved the problem by acquiring and converting two U.S. Navy barges, each 170 feet long and 34 feet wide, that had served as bomb carriers. One was outfitted as offices and the other as shops. They proved so satisfactory that they were

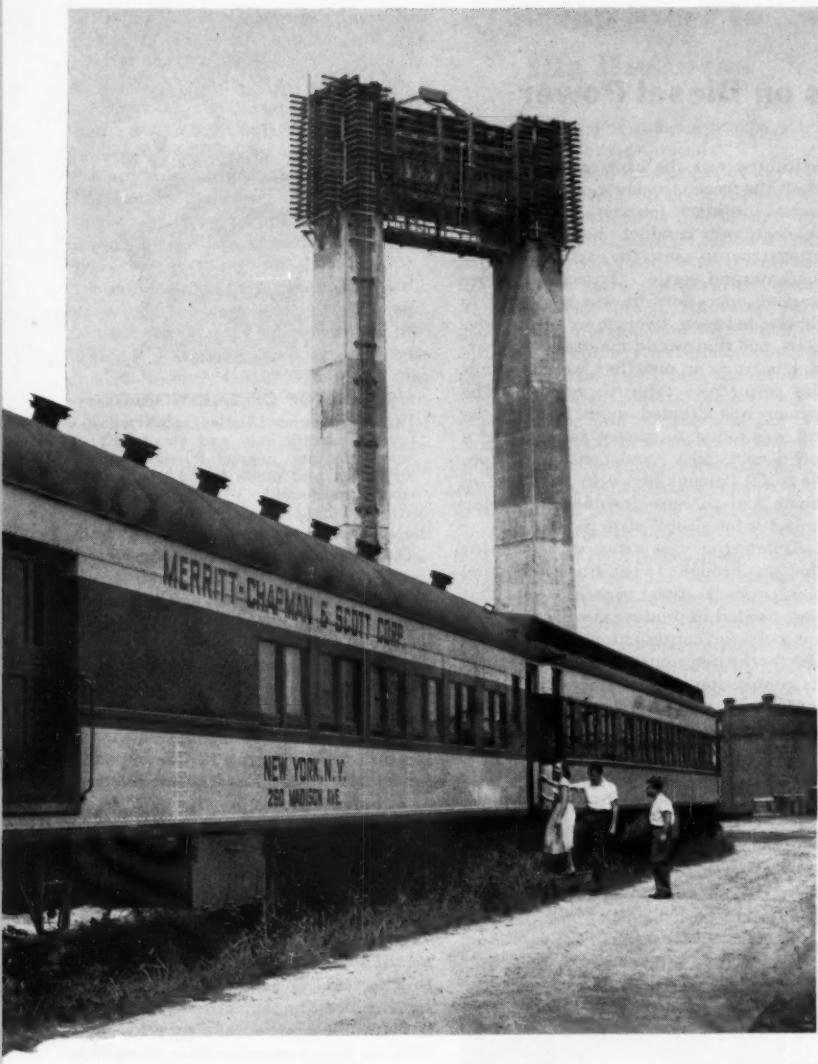
moved to the next M-C & S job, the Delaware River Memorial Bridge near Wilmington, Del. Later they were stationed at the Elizabeth River Tunnel, Norfolk, Va., and are now at Tarrytown, N.Y., where the New York State Thruway bridge is being constructed across the Hudson River.

One barge contains seven offices for Burton F. Sanders, the project manager, and other key personnel: the office manager, purchasing agent, auditor, field engineer, timekeepers, and their staffs. The craft is also provided with hospital facilities, its own oil-burner heating plant and a set of 48-inch attic fans for summer cooling. It is hooked up to shore-based water, electricity and telephone systems. A ship-to-shore radio-telephone enables the office to keep in touch with the firm's major pieces of floating equipment. The

OFFICES ON RAILS

Two made-over Pullman cars, parked in Savannah, Ga., housed the offices of Merritt-Chapman & Scott Corporation while it was building a bridge (note pier in background).





shop barge has everything needed for marine construction work from carpentry tools and a pipe-threading machine to a precision lathe, a blacksmith and forge shop, a battery charger and a cable stowage and splicing room.

The M-C & S Pullman cars were first used late in 1952 at the Eugene Talmadge Memorial Bridge, Savannah, Ga., which has now been completed. R. I. Senn, project manager, was responsible for them. The idea had been in his mind for some years, and conditions at that location were favorable for trying it out. Initially, two old cars were leased from the Central of Georgia Railway with the intention of equipping them for office duty by making minor interior changes. But it was soon decided to buy them and do them over entirely. They were decorated in green and gray, and desks and other furniture were designed to fit the available space. Exteriors are red and buff, the standard colors of the company's equipment, and carry the black-horse insignia of M-C & S.

In one car is the project manager's office, with an adjoining bedroom and bath for use whenever the working day lengthens into the night; quarters for the office manager and bookkeeper, a supply room, a receptionist-secretary's office and a ladies' lounge. The second car has offices for the project engineer and his assistants, the purchasing agent, timekeeper, and a file room and lavatory. The Pullmans are now on a railroad siding in Norfolk, Va., where the firm is building a 4-mile tunnel-bridge across Hampton Roads.

On major jobs, M-C & S also takes along a "rolling hospital." It is a bus especially equipped for the purpose with two beds, X-ray apparatus and first-aid supplies. A registered nurse is on duty every working day.



HIGHWAY HEADQUARTERS

Several of the contractors on the West Virginia Turnpike directed their operations from trailers. These two belong

to Condon, Cunningham & Kiewit, of Omaha, Neb., which built 6.3 miles of the route in Mercer County.

Thule Outpost Relies on Diesel Power

SET in a barren valley on the island of Greenland, only 900 miles from the North Pole and a few hours by jet bomber from Russian territory, is the northernmost American military stronghold, Thule Air Force Base. (The name is Latin and means farthest land.) For some years a joint United States-Danish weather station, the site was leased from Denmark for 99 years and a multimillion-dollar secret project, "Operation Bluejay," was begun in 1951.

Except for being a highly strategic location, it offered few advantages and many problems to the Corps of Engineers, U.S. Army, which planned and supervised the undertaking. During the short summer of 1951 work was begun on a full-scale year-round air base with a 10,000-foot landing strip and 480 acres of barracks, hangars, warehouses, fuel tanks, pipe lines, power stations and piers.

During the eight winter months in the Arctic the temperature may and often does drop to 50° below zero Fahrenheit, and fierce winds of 60 miles an hour and more sweep almost unceasingly over the land. Winter ice locks the seaways to navigation, and persons in the area at that time remain there until spring unless they are flown out.

From the standpoint of actual construction, the most difficult problem en-

countered was the ever-present permafrost, the frozen top layer of soil. In that region, ordinary foundations extending belowground conduct heat from the superstructures into the earth, causing it to thaw and settle. Therefore, before starting operations, it was necessary to choose between two types of foundations, one that would maintain the thermal balance or one that would permit the permafrost table to recede. The former was decided upon because the soil was found to consist generally of a low-density silty sand containing from 30 to 50 percent of ice in the form of lenses and to have insufficient bearing capacity for sizable structures.

Among the vast array of equipment that was brought to the site by ship and plane were 30 diesel generator sets that were needed to produce electrical energy not only for construction purposes but also for the maintenance of the base upon its completion. The engines that drive the generators are Ingersoll-Rand 4-cycle heavy-duty units designed for continuous full-load operation. The generator sets were bolted to thick concrete slabs resting on piles driven into the soil. Then the buildings were constructed around them with floors a foot or so aboveground, leaving an insulating air space between them and the frozen earth. Heavy concrete weights anchor



NEAR TOP OF THE WORLD

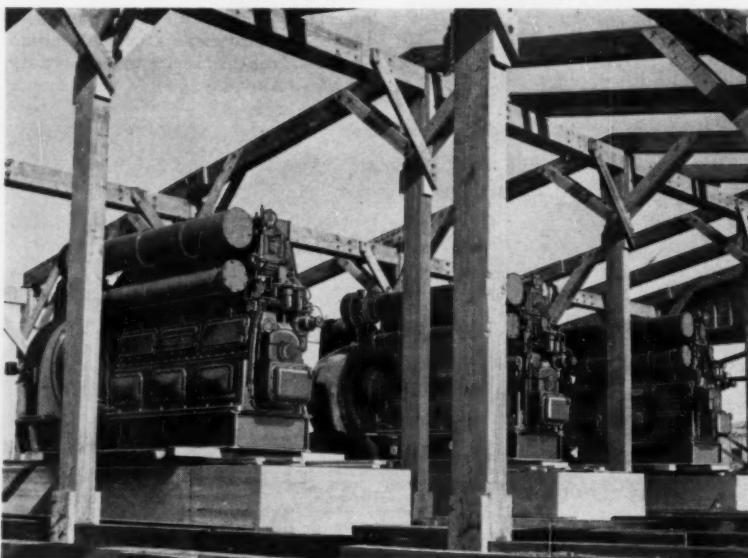
Thule (pronounced Tooley) is 900 miles from the North Pole and about 1300 miles from the nearest Russian territory. Its post office is the northernmost in existence.

the buildings against the violent winds.

One of the world's tallest structures is the 1213-foot radio transmission tower that was erected 7 miles from the main base during the summer of 1952. A part of Global Communications Network, it can flash messages around the world in 32 seconds and was designed to overcome interference from the aurora borealis and other Arctic phenomena. As the site on which it stands had to be maintained in a frozen state, the foundation was excavated in winter to a point 6 feet below the proposed bottom elevation of the concrete base. The opening was then backfilled with sand and gravel not susceptible to frost and the mass brought to the temperature of the surrounding soil. The base blocks were built on this insulating blanket and projected from 1½ to 2 feet above ground level. When it was finished, the foundation was allowed to settle for a period of six weeks. Not until it had reached a state of equilibrium was work on the tower begun.

Small buildings rest on pads of soil not affected by frost, and there is an air space of several feet between them and the insulated flooring. The huge hangars, which are said to be the heaviest structures ever erected on frozen ground, were provided with special pipes to circulate cold air underneath the thick concrete floors. Without this precaution the heat from the buildings would melt the permafrost and cause them to settle, if not collapse. The runways also have a dry, insulated foundation.

Four years of work at Thule has improved conditions so much that, in spite of the intense cold, the sharp winds and the whipping snow, men stationed there can live with as much comfort as at any other U.S. Air Force Base. Thule is a good-sized community today and of tremendous importance to the United States not only as an outpost of defense but also as a commercial airfield and as a weather station.



DIESELS DURING ERECTION

Thirty Ingersoll-Rand 720-hp diesel engines, each driving a 625-kva alternating-current generator, furnish electricity for the base. The machines are bolted to thick concrete blocks resting on piles extending into the ground. They were set up as shown, and the buildings were constructed around them.

THE horseman wrapped his cloak tighter about him against the chill wind of the April night. Nervously he adjusted his saddle girth as he peered anxiously at the farther shore of the river. A dim light flickered — a second followed it — the rider was in his saddle in a minute urging his horse to a gallop. The iron horseshoes rang out on the rough cobbles, and Paul Revere was off to warn his waiting comrades and change the history of the world.

Iron horseshoes, and the next day the blaze of iron muskets to start a war, create a new country—a new way of life! Where are those horseshoes and those muskets today? Gone? Used up? Not necessarily. They may be part of your wife's automatic dishwasher, for each of our present-day necessities contains some scrap steel, one of man's few products which almost never "dies."

When you drive past a huge city scrap yard, or small country-town area piled high with old autos, stoves and machinery, have you ever thought that they represent part of a vital business that has helped the world's wheels go 'round for thousands of years? In the fourth chapter of Genesis a man is described as "an instructor of every artificer in brass and iron." The man was Tubal-cain, seventh in descent from Adam, and the time was nearly 5,000 years ago. It is almost certain that his instructions included the admonition to be sure to throw back into the furnace any waste in the process of smelting iron.

In Isaiah and Micah we read about beating swords into ploughshares. Does that remind you of the sale of scrap from the world's battlefields a few years ago? Chaucer, father of English literature, earned money in his youth serving as clerk of the works at the Tower of London, and as part of his duties he compiled an inventory of scrap material. In 1793 George Washington, when President of the United States, signed a requisition for a new frigate anchor chain but not without observing: "Approved, but is there an entire loss of the old one?"

Until 1642 all iron products were imported into this country from Europe. In that year the first iron casting was poured in the new world by a Mr. Jenks. It was a 3-legged, 1-quart kettle that is now on display in the Lynn, Mass., public library. Without doubt the surplus metal or sprue obtained from this casting was used in making a second kettle. So it may be that Mr. Jenks was not only the first foundryman in North America but also the first scrapman.

Within 50 years there was a thriving iron industry along the Atlantic seaboard. Smelting bog or swamp iron ore, the foundries added scrap, for the buyer of an iron weapon or utensil was required, whenever possible, to turn in an old one. In 1864 the Bessemer process of making steel was discovered, and five

Scrap Steel Is Big Business

years later the first open-hearth steel was commercially produced.

While we have no records of any organization of scrap dealers in those days, the old-time peddler is famous in story and poem. With a pack on his back, and later with a horse and wagon, he made the rounds of farm and town. His wares were needles, thread, tinware, yard goods, mouth organs and toys—all welcome in the country. Farmers' families then had little cash, but the peddler knew that every tiller of the soil had a pile of bones and an accumulation of wagon tires and implements, while his wife had her rag bag. Swapping for these, the peddler returned to town with a wagonful to sell to the waste-material yards which had sprung up.

The oldest scrap company in the United States started in this manner in 1862, and in 1865 the first open-market quotation on scrap appeared in a Boston paper. Shortly thereafter a predecessor of the American Iron and Steel Institute began publishing prices, and they have been carried regularly since that time by trade papers, as well as many dailies.

In preparing its scrap for sale, the industry meanwhile progressed from chisels, sledges and strong backs to cutting torches, magnets, grapples and enormous buckets. Today it is as modern as any other, and makes use of every mechanical or labor-saving device possible. Trucks have replaced the horse and wagon; hydraulic presses simplify baling, loading and shipping; and shears and oxyacetylene torches complete the equipment of the mechanized yard.

The scrap business has always been a highly individualistic one, and even today it has been termed "the last outpost of strictly free enterprise in the iron and steel industry." But two wars, with their insatiable demand for steel, could not fail but bring it into the category of big business. So it organized the Institute of Scrap Iron and Steel and took its place in the economy of the country. Grades were standardized, prices were established nationwide and consumption grew from 26 million tons in 1917 to more than 69 million in 1953.

In 1954 scrap handling was recognized as a national industry of such importance that scrap steel was added to the list of commodities traded on one of the country's largest futures markets, the Chicago Mercantile Exchange. The great-grandson of the peddler can now sit in his office, buy scrap that may be miles away by telephone, look at the price on the exchange as it appears on the ticker tape and "hedge" his purchase through his broker on the exchange floor just as the cotton man can on the Cotton Exchange, or the grain man on the Board of Trade.

So has this "Steel Cinderella" found the prince with the glass slipper and emerged as a deathless princess whose progeny lives no man knows where! What will next be the life of the Queen Mary plates rolled from scrap taken from World War I German warships? Or, years hence, where and in what guise will be the steel girders of the new Potomac River bridge at Washington which were taken from the sides of the French liner *Normandie*?

When next you see a load of scrap, or a yardful, don't sneer at its battered and rusty look. It may have a longer "family tree" than you.



MARKETPLACE FOR SCRAP

Scene in the Chicago Mercantile Exchange as buyers and sellers agree on prices of scrap for future delivery.

WITH this issue we enter upon our sixtieth year of publication. Now, as in the beginning, our journal is the only one in America devoted primarily to chronicling the accomplishments of compressed air in its diversified and continually enlarging fields of application. We have grown, along with the industry, in size and number of pages, volume of advertising carried and variety, extent and—we hope—quality of editorial presentation.

It was a very different world in which William Lawrence Saunders launched the publication in March of 1896, because "thus far the subject (compressed air) has been treated in only a fragmentary way . . . and has suffered for want of publicity." There were definite signs, however, of the dawning of the great age of miracles and mechanisms in which we live today.

In that same month of March the first automobile appeared on the streets of Detroit, the citizens of which little dreamed that it was to become the world's motor-car capital. The machine was powered by a 4-cylinder, 4-cycle, water-cooled gasoline engine and built by Charles B. King, who had been one of the two sole finishers in America's first automobile race in Chicago the year before. Later in 1896 Samuel P. Langley flew a steam-powered airplane over the Potomac River. Americans witnessed their first motion picture, flashed on the screen of Koster and Bial's Music Hall in New York by Edison's Vitascope.

In 1896, also, gold was discovered in the Klondike. Few of the thousands that rushed northward and endured great hardships to seek their fortunes would have believed anyone who might have told them that gold mines would be having a hard time staying in operation in 1955. Neither would they have believed that an announcement made that year in France would have vast future significance and touch off frantic searches for another metal of which they had probably never heard. That news was the report by H.A. Becquerel of Paris of his discovery that uranium at ordinary temperatures emits an invisible radiation like that from X-rays. For his research in this field he, jointly with Pierre Curie, was awarded a Nobel prize in 1903.

William McKinley of Ohio, who was to die from an assassin's bullet, was elected president of the United States in that year on a gold-standard platform. He defeated William Jennings Bryan of Nebraska, foremost advocate of silver coinage and the leading oratorical spell-binder of the day. The urge to explore unknown lands was as strong then as it is now, and Admiral Robert E. Peary had just made his sixth trip to the Arctic.

Compressed air was, as already mentioned, becoming important, but it wasn't getting ahead without a struggle. Steam power had to be dislodged from its

Happy Birthday—To Us

stronghold in most fields of industry, and another brash contender was just coming on the scene. That was electricity, which soon proved that it was here to stay. In the end, the three mediums of power transmission learned to live together, complementing one another.

In a paper delivered before the Engineering Society of Columbia College, in New York City, F.C. Weber, a mechanical engineer, listed the leading uses of compressed air as follows: for operating rock drills, hoists, railway brakes, switches and signal devices; molding machines, sandblast equipment and chipping hammers in foundries; cleaning railroad car seats, sinking caissons, caulking pipes, and pumping water by the Pohle air-lift system. "Its use in the mine and tunnel is probably the most general," he reported.

In our third issue it was boldly stated that "the compressed air machine is no longer an experiment. It is a great commercial fact, a force to be reckoned with . . . It has come out of its period of infancy into full citizenship in the realm of latter-day industry."

The Chicago Drainage Canal had been but recently completed at that time and compressed air had been of great aid in its construction. The projected Nicaragua Canal, forerunner of the Panama Canal scheme, was receiving the attention of the U.S. Congress and it was observed that "it is in such a work that compressed air distinguishes itself."

One of our first issues illustrated and described the shearing of sheep in Australia with pneumatic clippers. The air brush for artists received attention, and air-operated whistles as fire alarms were reported to be popular. The Little Giant rock drill had been put to use tapping blast furnaces by the Maryland Steel Company, Sparrows Point, Md. The Aqueduct Commissioners of New York were transforming the Jerome Park horse-racing course into a distribution reservoir for the city's water. John B. McDonald, who was later to build Gotham's first underground railroad lines, had the contract, which involved excavating 7,000,000 cubic yards of material, almost half of it rock. He was introducing a new wrinkle by piping the air from a central steam-driven compressor plant through up to 2000 feet of 8-inch line to the fourteen rock drills, fourteen hoisting engines and three water pumps employed on the job.

Compressed air was replacing steam as a source of power for running machinery in the shops of the Pullman Palace Car Works in Chicago. The changeover was decided upon after representatives had observed air power at work in the repair shops of the Santa Fe Railroad in

Topeka, Kans., and of the Union Pacific in Omaha. The Pullman plant had been using ten steam engines, each stationed near the machines it drove indirectly through belting from an overhead maze of shafts and pulleys. An estimated 30 percent of the power was expended in turning the transmission equipment.

The belts, it was reported, "not infrequently pick up a workman and whirl his life out." When a machine was at a standstill its belt was slipped aside to an idler wheel but continued to travel. With air, however, the operator just had to turn a valve to control it. Previously, Pullman had been utilizing air for hoisting, testing brakes and cleaning car carpets and upholstery.

Horse cars were then giving way to "trolley" cars run by electricity, but compressed air also had its champions. Our second issue reproduced a cartoon from the Chicago *Times-Herald* which pictured a youthful figure labeled "Compressed Air" brandishing a sword in front of the trolley, which was depicted as a skeletal symbol of death with jagged bolts of electricity emanating from it.

In July, the first of two cars driven by air motors and designed by Robert Hardie arrived in New York for service on the Third Avenue line. They were manufactured in Rome, N.Y., by the American Air Power Company, were 28 feet long and seated 28 passengers. Compressed air was stored in a tank under 2000 psi pressure, and there was a tank of hot water to heat the air and thus expand it just prior to its use.

Another New York proponent of air-powered transportation was Herman Haupt, a veteran railroadman and an engineer of high standing who was president of the General Compressed Air Company and had been chief engineer of the Pennsylvania Railroad. Chicago also tried out air-operated street cars in 1896. They had air tanks under the seats with a combined capacity sufficient to run 17 miles before recharging. Advocates of compressed air were also promoting it as a means of operating trains on the proposed subway but lost out to electricity.

Pneumatic tubes were very popular in Europe and gradually being introduced here. Railroad shops were beginning to use air-driven tools, and our July issue carried a notice about a convention of Railway Master Car Builders and Master Mechanics, at Saratoga, N.Y., where they were to be demonstrated. A leading builder of pneumatic hammers was Wolstencroft Pneumatic Tool Company.

Now, 60 years after the founding of the magazine, we can do no better than repeat the first editor's declaration that "compressed air, as a useful power, demands attention. Its scope of usefulness is each day widening, and its possibilities are beyond conjecture." It is our guess that its field of application will continue to grow at an undiminished pace.

This and That

Synthetic Handles For Axes Axe handles of plastic reinforced with glass fibers are being used by the Canadian Army in the extreme cold of the northland.

Wood—usually hickory—is the traditional axe-handle material, but it shrinks in temperatures of 50° to 60° below zero. Laminated birch was tried but became brittle. So did a rubber-and-plastic mixture. Solid magnesium was too heavy, and hollow magnesium too light. The glass-and-plastic combination doesn't warp, has no grain to split and won't break or chip if a tenderfoot whacks a tree with the handle instead of the blade. It has about the same weight and whip as hickory.

* * *

Golfers Outwit Prospectors There used to be a saying that gold is where you find it, meaning that there are no set rules for the seeker to

follow and that ore may crop up in unexpected places. Apparently, this statement applies even more so to uranium. Traces of it are widespread, and there are probably few extensive areas that have none of the new wonder metal. Prospectors are discovering it in so many different places that it might pay any of us to buy or borrow a geiger counter and give the front- and backyards the once over. Also, to protect our interests, we might file a claim on our own property. If you think this is a farfetched idea, read what happened up in Canada recently.

At Oka, in the Laurentian Mountains and about 45 miles west of Montreal is the monastery of an order of monks that makes the famed Oka cheese. A few weeks ago prospectors wandered over the grounds and got such vigorous responses from their mechanical detectives that a claim-staking orgy ensued. It is customary to mark claims by blazing trees, and in the absence of other varieties the excited fortune hunters did a thorough job on the apple orchard. When the neighbors heard what had occurred they began to have uneasy feelings that the rush might spread. Nearby is a beautiful golfcourse, much treasured by the members, who are largely Montreal residents. With dreadful thoughts in their minds about what might happen to their fine trees and carefully kept turf, they began glancing furtively towards the horizon for signs of approaching hordes with clicking counters.

Then somebody had a bright idea. Why not file mineral claims on the land themselves? Almost in no time they did just that and began breathing easier. They don't know whether or not there is

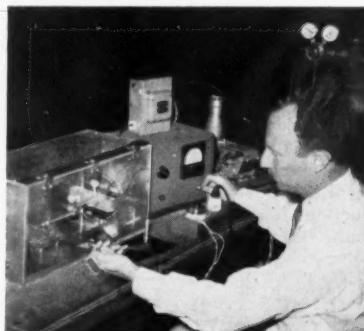
uranium beneath the rolling fairways and velvet-textured greens, and they don't particularly care so long as they are sure that no one is going to interfere with their play and their privacy.

* * *

Blasting Test Coatings The National Bureau of Standards is using the abrasive blasting method to measure the wear resistance of organic

coatings for metal surfaces. With carbon-dioxide gas as the propelling medium, fine abrasive particles are shot against a surface at varying angles and from different distances. For the most part, the nozzle is held 0.04 inch away from the coating and at an angle of 90° or 45°. The gas pressure is 40 psi, and the abrasive flows at the rate of 0.15 gram per second.

The tests are carried out in a rectangular chamber of brass having a trans-



parent plastic front door and top. The specimen and nozzle assembly are mounted so that distance and angle may be changed at will. A solenoid valve operated by a manual switch turns the flow of abrasive powder on and off. The spent material and the dislodged coating debris are removed through a vacuum exhaust outlet at one end of the chamber. The apparatus was set up primarily to evaluate the effectiveness of finishes for naval aircraft. The test continues until bare metal shows up in the area, and the time it takes for this to happen is recorded. The work is sponsored by the Navy Bureau of Aeronautics.

* * *

Long Beach Combats Subsidence Officials of the city of Long Beach, Calif., are faced with a huge job in trying to repair damage wrought by the income-producing oil wells in the 10x5-mile harbor area of the Wilmington Field. To combat subsidence of the earth resulting from pumping oil from underneath, an

estimated 15,000,000 cubic yards of dirt will be piled on the surface within the next decade at a cost of around \$34 million.

In addition to the earth-fill undertaking, a new approach to the problem is being sponsored by the Long Beach Harbor Department, which is engaged in determining whether repressuring will retard settlement. Long Beach Oil Development Company and Richfield Oil Corporation, as contractors for the city, are injecting both gas and water on a trial basis. Although there hasn't been time to evaluate the methods either as cures for subsidence or for stimulating oil production, it is expected that any new development contracts or drilling permits will stipulate that pressure be maintained from the beginning of operations.

* * *

Helicopters Check on Woodpeckers

Scientific care of forests in Sweden has removed most of the dead trees in which woodpeckers formerly hollowed out nests, so the birds have turned their attention to the dry, seasoned poles that carry power transmission lines from the waterfalls of Lapland to the industrial areas to the south. Impregnating the uprights with creosote and other attempts to drive the woodpeckers away have been ineffectual. As the perforations damage the poles in time, it is necessary to inspect them regularly and replace those that are near failure.

The roadless, uninhabited areas traversed by some parts of the lines are difficult to travel, and each of the men on foot who formerly examined the poles could visit only about 40, spread out over a distance of 5 miles, in a day. Helicopters were recently adopted for this service, and each can cover 120 miles daily. A machine hovers over a pole for 30 seconds while the inspector checks on the condition of the wood and also the insulators. He dictates his findings into a tape recorder, from which a written report is made up later.

* * *

Faster Air Brake As early as 1852 a United States patent was granted on a railway brake operated with steam, and several pneumatic brakes were patented in England a few years later. But the first dependable air brake was invented in America in 1869 by George Westinghouse. That was the "plain brake," which was improved upon in 1872-73 and made so that it would be applied automatically in case of an ac-

cident such as a train breaking in two or failure of an air pipe. In 1887, Westinghouse introduced other elements that made it possible for the first time to stop a train of 50 or more freight cars within a short distance.

Now the Westinghouse Air Brake Company has developed a new brake-control valve that still further speeds up the braking action. With it, it is claimed, the brakes on the rear cars of a 1½-mile freight train begin to function only nine seconds after those at the head of the train. This action is reported to be four or five times faster than that of any other pneumatic braking system. Major components of the new valve are of aluminum and weigh only 60 percent as much as comparable parts of valves now in general use.

★ ★ ★

Helium Demand Mounting

The rigid type airship was originated by Count Ferdinand von Zeppelin and, as subsequently developed by the Germans, became an important bomb carrier in World War I. This caused other leading nations to explore its possibilities. The German zeppelins had one great disadvantage; they were kept aloft with flammable gases. The United States fortunately has large reserves of nonflammable, lighter-than-air helium contained in natural gas from certain areas, and this resource is highly prized. Although planes have taken over most of the military functions of the early dirigibles, our Navy used blimps—nonrigid airships—effectively in hunting down submarines during World War II and still maintains a sizable fleet of them.

Because helium was a "strategic" element, the Government took over its production after World War I and the Navy built three experimental processing

plants in Texas and then, in 1921, a full-scale establishment at Fort Worth, Tex. All obtained the gas from the Petrolia Field in that state. In 1925 all helium operations were placed in charge of the Interior Department's Bureau of Mines, and in 1929 a large processing and compression plant was constructed near Amarillo, Tex. Others were added later, but some have been discontinued. The three that remain are at Exell, Tex., Shiprock, N.Mex., and Otis, Kans.

The helium content of natural gas ranges from a mere trace in many fields to 7½ percent in the Rattlesnake Field, which supplies the Shiprock plant. Normally the carbon-dioxide and nitrogen in the gas are extracted while the helium is being removed. The Government has put \$12 million into these facilities and runs them on a businesslike basis by setting aside \$600,000 annually to amortize the investment. The four plants can produce more than 200 million cubic feet of helium annually, and the 1954 output was reported as being at near capacity rate.

Today the government uses only a minor part of the total for dirigibles, the principal applications being in shielded arc welding, for services in the atomic-energy program and as motive power for guided missiles. About 70 percent of the yield is consumed by government agencies, which get the gas at cost—\$14.65 per 1000 cubic feet; the remainder is sold to commercial buyers at \$19 per 1000 cubic feet. Most of the latter supply is used for welding, medical purposes and, more recently, to prevent oxidation of titanium during its metallurgical treatment.

The Bureau of Mines was given \$6,000,000 at the last session of Congress with which to expand its production facilities. It is expected that a new plant will be located where it can readily obtain gas from the Keyes Field in Oklahoma, which contains 2 percent of helium and also 20 percent of nitrogen.

★ ★ ★

Lighthouse To Rise In Sea

India is conducting test borings in the bed of the Gulf of Kutch preparatory to erecting a lighthouse at Lushington Shoals 20 miles off Kandla. It will be the first structure of its kind in Asia to rise directly from the ocean floor. In its exposed position it will have to be built strong enough to withstand the battering of waves up to 50 feet high. Mariners have long complained of the lack of navigational aids in this stretch of shoals that must be crossed to enter or leave the gulf. Kandla Port is now being developed, and as it is expected to handle a million tons of shipping annually within a few years the provision of a lighthouse is becoming urgent.



"They figured it would be cheaper if we laid the four-, eight- and sixteen-inch pipe together."

HE FORGOT

He brushed his teeth twice a day with a nationally advertised tooth brush and a miraculous tooth paste that killed germs, kept his teeth white, and gave him an irresistible smile.

The doctor examined him twice a year.

He wore rubbers whenever it looked like rain.

He slept with the windows open.

He stuck to a diet of plenty of fresh vegetables.

He relinquished his tonsils and traded in several worn out glands.

He golfed, but never more than 18 holes.

He never smoked, drank or lost his temper.

He got at least eight hours of sleep every night.

The funeral will be held next Wednesday. He is survived by 18 specialists, 4 health institutes, 6 gymnasiums, and numerous manufacturers of health foods and antiseptics.

He had forgotten about trains at grade crossings!

ERIE WORKS NEWS
GENERAL ELECTRIC COMPANY

A western mining paper comments that Canadian gold mines get a government subsidy of around \$16 million annually to help compensate for the inflexible price of gold, which has been pegged at \$35 per ounce since 1933. The U.S. gold miner gets ulcers.

COURTEOUS RATS

Reminiscing in the *Journal of the Franklin Institute*, Walter Pertuch, veteran Institute librarian reports an incident that happened in 1911 when surplus magazines were stored in piles in the dirt-floor cellar. Rats invaded the enclosure and began eating the glue off the backs of the magazines. Two dogs and a cat were procured over a period of weeks but they all seemed to be afraid of the rodents, so the management bought Mr. Pertuch

—AIR JETS—

a .22-caliber rifle with which to shoot them. A newspaper reporter who happened to hear about it embellished the facts but made a good story. According to his account, "these Franklin Institute scientific rats" always placed each magazine back in its proper pile after dining on the glue.

Mother—"Isn't this toy too complicated for a small child?"

Clerk—"It's an educational toy, madam, designed to help the child adjust himself to the world of today. Any way he puts it together is wrong."

NOTE TO GEOLOGISTS

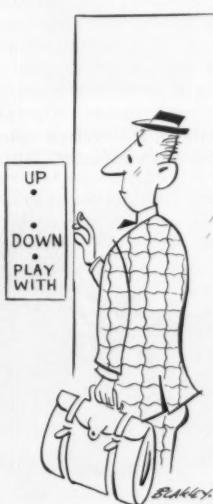
In an otherwise dry but complete report of the geology in part of the Flin Flon area of Northern Manitoba, a geologist who spent some time there last summer states as follows: "Pronouncedly glaciated mineralized outcrops show only superficial weathering in this district. A good example of this can be seen near the present liquor store across the railroad tracks from the Flin Flon hotel. A geologist should not go past this outcrop." —NORTHERN MINER



THE DESIGNER'S DREAM

The designer bent across his board,
Wonderful things in his head were stored.
And he said as he rubbed his throbbing bean,
"How can I make this thing tough to machine?
If this part here were only straight
I'm sure the thing would work first rate.
But 'twould be so easy to turn and bore
It never would make the machinists sore.
I better put in a right angle there
Then watch those babies tear their hair.
Now I'll put the holes that hold the cap
Way down in here where they're hard to tap.
Now this piece won't work, I'll bet a buck,
For it can't be held in a shoe or chuck.
It can't be drilled or it can't be ground
In fact, the design is exceedingly sound."
He looked again and cried—"At last—
Success is mine, it can't even be cast!"

—K. LANE



POWER OF SUGGESTION

A man lived by the side of the road and sold hot dogs.

He was hard of hearing so he had no radio. He had trouble with his eyes so he read no newspapers.

But he sold good hot dogs.

He put up a sign on the highway telling how good they were.

He stood by the side of the road and cried: "Buy a hot dog, Mister."

And people bought.

He increased his meat and bun orders. He bought a bigger stove to take care of his trade.

He got his son home from college to help him.

But then something happened . . .

His son said, "Father, haven't you been listening to the radio?

There's a big depression on.

The European situation is terrible.

The domestic situation is worse."

Whereupon the father thought, "Well my son has been to school.

He reads the papers and he listens to the radio, and he ought to know."

So the father cut down on his meat and bun orders,

Took down his advertising signs, And no longer bothered to stand on the highway to sell hot dogs.

And his hot dog sales fell almost overnight.

"You're right, son," the father said to the boy.

"We are certainly in the middle of a great depression."

—OAKITE NEWS SERVICE

A subway was being dug and a drunk stopped beside the excavation and called down to the man at the bottom of the pit—"Shay, watcha doin' down there?"

"Building a subway."

"How long's it goin' to take to build it?"

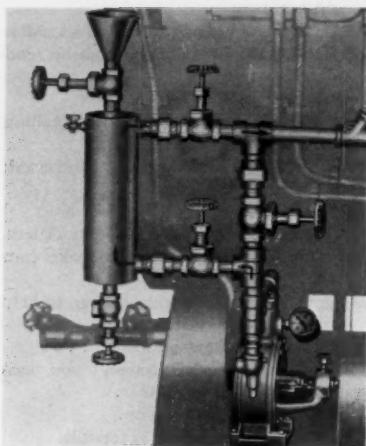
"Three years."

"The heck with it. I'll take a taxi."



"Basically, all we've got to do is straighten and flatten it."

Industrial Notes



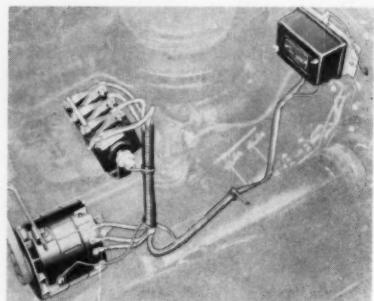
side of the boiler feed pump the latter is subjected to less wear than would otherwise be the case. The feeder tank has a capacity of 2 gallons. With the by-pass it is possible to direct the feed water through the tank containing a measured amount of chemicals or to pipe it right from the pump to the boiler by adjusting three valves. The unit is tested to withstand pressures up to 200 psi and is especially suitable for low-horsepower boilers, where make-up water is introduced infrequently or for service in locations where the water does not require heavy treatment.

Circle 1E on reply card

"Solution ceramics" are something new in coatings, according to the Ceramics and Minerals Research Department of the Armour Research Foundation. They differ from conventional materials such as porcelain enamel in that they are not brittle and can be applied by ordinary spray gun to well-nigh any solid surface that has been cleaned and heated. But unlike sprayed ceramics which use clays, cements or organic adhesives for bonding, solution ceramics contain no bonding agent. So far, of the many widely varying types available, the refractory metal oxides such as zirconia, chromia, titania, ceria and mag-

nesia have undergone most intensive investigation, but certain phosphates, silicates, fluosilicates, oxyhalides and even metals can be applied in separate layers or codeposited. The new process is available to industrial firms through license agreements.

Motor cars in need of battery charging can be taken care of on the spot by means of a system recently announced by Leece-Neville Company. It consists of an Alternator, of a rectifier to change alternating to direct current and of a special reg-



Where water or boiler conditions do not warrant the installation of expensive mechanical proportioning equipment to treat boiler make-up water, it would be of advantage, says the Cyclotherm Division of United States Radiator Corporation, to use its Chemical By-pass Feeder. The unit permits adding either liquid or powdered chemicals to the feed water for any hot-water or steam generator regardless of make, and as the compounds are introduced on the discharge



A COMPLETE LINE OF AIR CONTROL EQUIPMENT

Including precision-made HEAVY-DUTY

AIR MOTORS

WITH "SEALED-IN LUBRICATION" Pat. Pend.

Wide choice of electric and/or air controls and mountings. For air pressures up to 200 P.S.I. Standard bores 1½"-2"-3". Any desired stroke. Larger bores on special order.



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Engineering Department

freely on all air automation
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Trained factory personnel
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Write for Catalogs
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"Sealed-in Lubrication"
Assures long break-away
on long idle units —
ample sealed-in oil for
thousands of cycles without attention.



AIR CYLINDERS
1½" to 8" bore



3 or
4-Way
AIR
POWERED
VALVES

Air or electrically operated. J.I.C. Standards.



COMBINATION VALVES
Panel units, hand and foot
operated valves. Wide range
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Lehigh Minor
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Low priced, light duty.
For air operated jigs,
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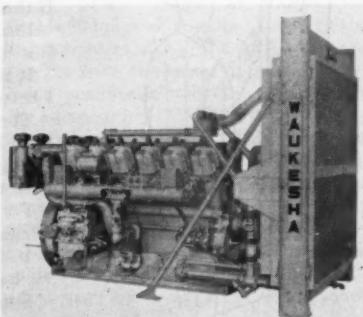
ADV. 19 (86)

Circle 16A on reply card

ulator, all easily installed in a conventional service truck and replacing the standard generator. Two cables, permanently fastened to the rectifier, are coiled and hung on the truck's fire wall. In operation, these are attached to the discharged battery which, provided it is not dead, will start the disabled vehicle in from five to ten minutes. With the service truck's engine at fast idle, the Alternator Charging System is said to produce approximately 80 amperes.

Circle 2E on reply card

In answer to the demand for stepped-up horsepower in all fields using heavy-duty internal-combustion engines, Waukesha Motor Company has introduced a new series of 12-cylinder power units, the Model VLR. It is a high-compression, overhead-valve, 4-cycle engine with 8½-inch bore and stroke and a displacement of 5788 cubic inches. Operating on propane-butane, it develops approximately 870 hp with radiator, fan and



COMPRESSED AIR MAGAZINE

air cleaners, while ratings of normal and turbocharged diesels are about 800 and 1100 hp, respectively. Also available for burning natural gas. It is claimed that a VLR will, in many instances, eliminate the need of engine compounding and enable a plant to reap all the benefits incident to cutting out one unit.

Circle 3E on reply card

Zippered overcoats in varying colors are the latest thing for insulated piping. Called Protektinsul, they are provided with a patented polyvinyl closure that locks and forms an air- and watertight joint. Cutting and fitting is not required because they are made to exact specifications.

Circle 4E on reply card

To eliminate oil mist and smoke at the source, Dollinger Corporation is offering a packaged ventilating system—its new Electro-Staynew Mist Collector. Installed near a high-speed grinding or cutting machine, it consists of a cabinet containing, from top to bottom, a power pack, a fan assembly, a removable filter, an ionizer-collector cell, a chip screen

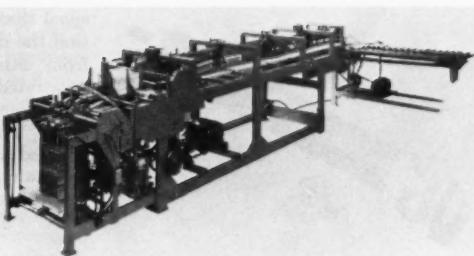


and an oil reservoir. The contaminated air is drawn into the base of the unit where the screen removes the entrained abrasive material and the particles of mist are given a positive charge in the ionizer cell. There the oil is separated from the air stream by negatively charged plates on which it collects and from which it drops through the screen into the reservoir, thus keeping both screen and cell clean. Next the air passes through the filter, which traps any agglomerate that might be blown off the plates, and then out into the shop. The oil that accumulates—from 2 to 6 gallons daily—may be stored in the reservoir and drained or piped back to the

machine for reuse. There are three models with capacities of 800, 1200 and 1600 cfm. All components can be readily withdrawn from the cabinet either for inspection or maintenance.

Circle 5E on reply card

Periodicals can be flat-fold-, or band-wrapped for mailing by one machine designed by Clybourn Machine Corporation. Entirely automatic in its operation, the wrappers are fed continuously by suction from a stack that contains about an hour's supply, while the books are loaded into the top of a hopper which feeds them from the bottom, thus preventing shutdown. The adhesive applicator works from beneath, so glue cannot drip on the work or the machine. Changeover time varies: from one size magazine to another using the same wrap takes only a few minutes; but from a small flat-wrap to a large fold-wrap book, for example, requires approximately one hour. The machine, named Auto-Wrap, is said to have an hourly capacity of from 3500 to 6000 periodicals, varying from 5x7 to 11x16 inches in size and from 1/64 to 1 inch in thickness, and delivers them, fanned out, on a 12-foot-long variable-speed conveyor. Optional



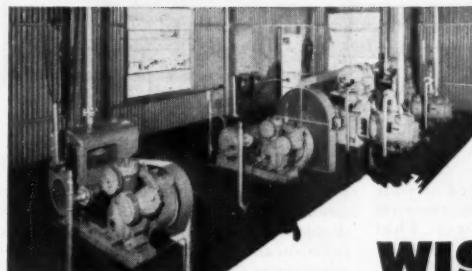
equipment includes imprinter, addressing head, electric counter and inserter.

Circle 6E on reply card

Ryan Aeronautical Company has a portable pneumatic test cart and oiler that is wheeled through the shops to check rotary-type air tools at points of use. Any that are found to operate below their rated efficiency are removed from the production line for repairs. As a result of the continual control, tools are kept in good working condition at an appreciable saving in cost.

Pneumatic cylinders with an air or electrically operated valve built in the rear head have been announced by The A. K. Allen Company. Designated as Allenair Models SVA and SVE, the units are obtainable with bores of 2 and 3 inches, a maximum length of stroke of

compressor POWER to meet Emergencies



This Ingersoll-Rand T-series Type 30 Compressor, powered by a Wisconsin Heavy-Duty Air-Cooled Engine, is ready to start instantly, then go to work and stay hour after hour... whenever emergency compressor power is needed.

In the oil fields, where equipment reputation is built by reliability, Wisconsin Engines predominate in the 3 to 36 hp. range. When such features as tapered roller bearings, fool-proof air-cooling, a trouble-free ignition system with easily serviced OUTSIDE magneto are built into every Wisconsin Engine... the end result can only be the delivery of heavy-duty lugging power *always*.

4-cycle single-cylinder, 2-cylinder and V-type 4-cylinder models, 3 to 36 hp. Write for Bulletin S-164.



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WISCONSIN MOTOR CORPORATION

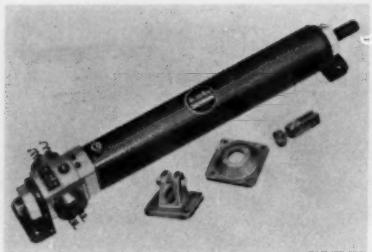
World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

Circle 17A on reply card

A 8150-1/4A

(87) ADV. 20



spool that is said to insure positive motion the instant air is momentarily bled from either end of it. The cylinder illustrated is a Model SVE provided with two solenoids for 8- or 110-volt operation. The solenoid coils are completely encased in a resin so as to protect them against moisture. The type SVA has two bleeder valves.

Circle 7E on reply card

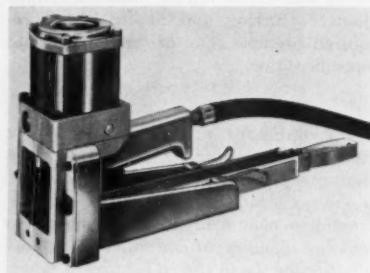
Two new polishing oils for grinding and finishing metals have been prepared by D. A. Stuart Oil Company and Minnesota Mining & Manufacturing Company. Both are named Excelene and are applied to abrasive belts to reduce

60 inches and with or without adjustable cushions. The valve is of the slider type and features two integral speed controls and large ports throughout for fast action. The slider is actuated by a

loading, to give them longer service life, to speed up grinding and to improve finishes. Type FD is for ferrous metals and NF for nonferrous. The oils are supplied in 12-ounce pressurized cans and are sprayed on by pressing a button.

Circle 8E on reply card

As a replacement for its HPA stapler of the portable pneumatic type, International Staple & Machine Company has announced a model of new design, the AB-1, which weighs only 8 1/4 pounds, or 15 1/4 pounds less than the earlier unit.



This great reduction in weight is brought about by the use of a 2-cycle air motor, plus the elimination of heavy materials and complex mechanisms. As there is no need of a return-cycle air valve, the tool operates without the machine-gun effect incident to continuous cycling. It is equipped with the company's exclusive retractable 2-anvil stapling head and uses air at 50 psi. Penetration of anvils and staple is adjustable to prevent marring fragile contents of cartons.

Circle 9E on reply card

AUTOMATION



Pulsating Panels assure constant material flow from bins and hoppers

Automation is an empty word if your production is interrupted by material hang-up in bins and hoppers. That all-important initial step of material introduction must move smoothly, flawlessly or the whole concept of automation is destroyed. PneuBin will solve your flow stoppage problems and reduce your operating expense. The PneuBin unit consists of steel-backed, neoprene, pulsating panels mounted on the inside walls of your present bins, and air controls to regulate the panels' action. By the

pneumatic inflation of the PneuBin panels, the bin contents are positively displaced to insure free flow. Automatic inflation and deflation continues in cycles at whatever frequency is set on adjustable control. PneuBin operates off the regular plant air supply.

PneuBin decreases plant operating costs by reducing maintenance and adding to the life of your bins; insures constant material flow; and greatly increases personnel efficiency through its quiet operation.

Send for "Flow Stoppage Report" and FREE literature. PneuBin engineers will gladly make recommendations with no obligation on your part.

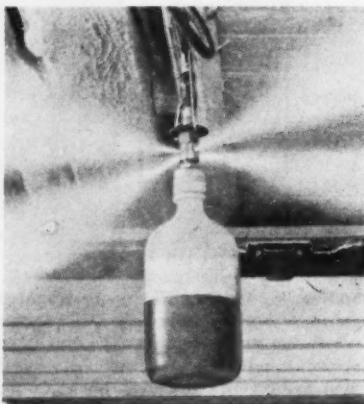
SOME FRANCHISED SALES TERRITORIES STILL AVAILABLE

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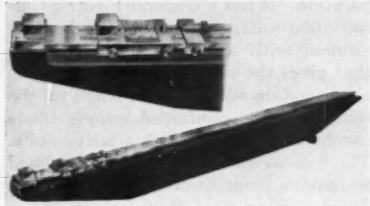
Circle 18A on reply card



PNEUMATIC FLY KILLER

Dairymen in Wisconsin have adopted the fogging system pictured to rid their barns of flies. The building is closed and air at 20 to 30 psi pressure is run into the 2-quart plastic bottle, which is hung from the ceiling. It holds pyrethrum spray liquid, and within five minutes virtually all insects in a 30x60-foot barn are dead. Windows and doors are then reopened. The cost of spraying daily during the hot-weather period is around \$20.00.

For both external and internal measurement, George Scherr Company, Inc., has introduced a length-measuring machine of new design that is said to simplify the work of accurately setting large micrometers, snap and pin gauges, standard bars, etc. Readings to 1/1000 inch and 1/50 millimeter are accomplished by

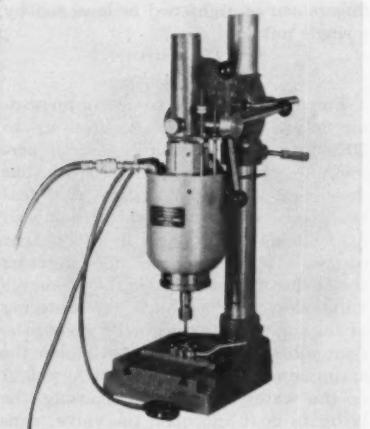


a steel scale and an extra-long vernier (2.45 inches). Scale and gauging members are mounted upon a substantial cast-iron base for maximum stability. Two sizes are available: an 80-inch and a 120-inch model weighing, respectively, 300 and 400 pounds.

Circle 10E on reply card

Capt. J.Y. Cousteau, the French naval officer who originated the Aqualung described in our August, 1953, issue, is using the diving equipment in exploring for oil in the Persian Gulf.

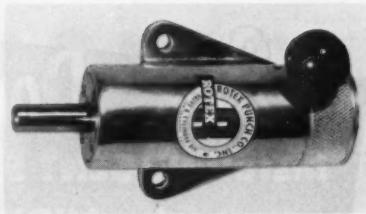
High-speed sensitive threading without tap breakage is the claim made by Smith & Wiese Company for its new tapping unit. The machine features an electropneumatically controlled air motor that provides for momentary tap reversals up to 200 cycles a minute. The tap chuck is driven through an ingenious triple-spiral spring mechanism which detects the slightest resistance to the cutting force. Any such resistance instantly puts into effect whatever rate of tap reverse and return the work may require to proceed smoothly and accurately. Air at 70 to 125 psi is used to operate the unit either automatically or semiautomatically with taps from No. 2x56 to



5/16 inch in size. It produces Class 3 threads in materials with a hardness range up to Rockwell 50C. Hole depth can be preset to within 0.0035 inch plus or minus, but the machine is said to work equally well with blind or through holes.

Circle 11E on reply card

For service with jigs and fixtures where space is limited, Rotex Punch Company, Inc., has developed a midget air cylinder with a sturdy hand-lever valve in the head, a combination that eliminates all but one hose line. It has a 1 1/8-inch bore and a 1-inch stroke and is designed for a maximum operating pressure of 160 psi. The unit can be connected to any shop



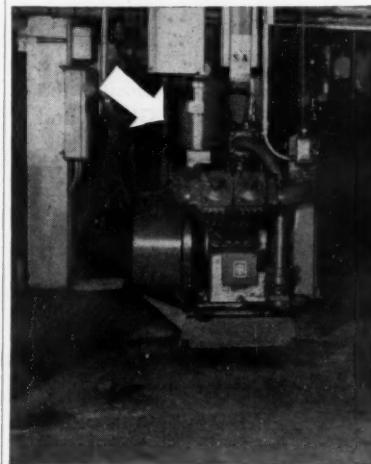
line and exerts sufficient power for a wide variety of clamping applications.

Circle 12E on reply card

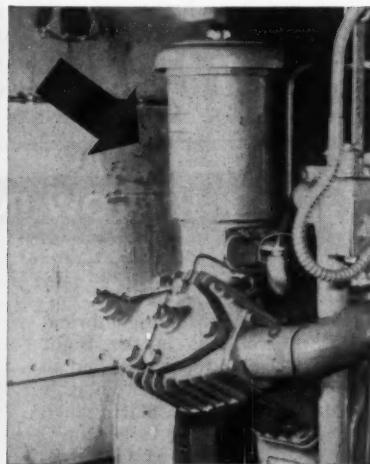
Workers who are required to wear protective garments are kept cool and com-

Whether you make chemicals or current...

Air-Maze filters will keep your compressors on the go!



AT THE BRIDGEFIELD, PA. PLANT of a large manufacturer of chemicals, control instruments are a vital part of production. The compressor pictured above supplies them with air. And, of course, it's equipped with an Air-Maze oil bath filter-silencer. The Air-Maze oil bath scrubs intake air clean in a bath of oil, reduces maintenance costs and downtime. The silencing feature quiets compressor intake noise.



THIS COMPRESSOR SUPPLIES AIR day in, day out at the new addition of the Jamestown Municipal Electric Plant, with the help of an Air-Maze oil bath filter-silencer. By keeping intake air clean, it keeps airborne dirt from damaging pistons, cylinder walls, rings, valves and other vital parts. This reduces overhaul costs, insures smooth operation. The silencing feature saves wear and tear on plant personnel.

AIR-MAZE

The Filter
Engineers

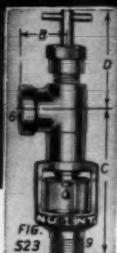
AIR FILTERS • SILENCERS • SPARK ARRESTERS
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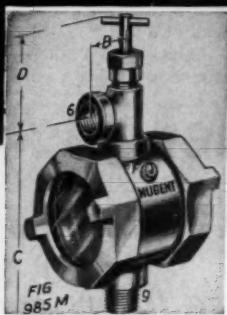
Circle 19A on reply card

See...Don't Guess

Install NUGENT Sight Feed Valves for LUBRICATION CONTROL



13 models designed for working pressures to 125 psi. Sizes to $\frac{1}{4}$ inch.



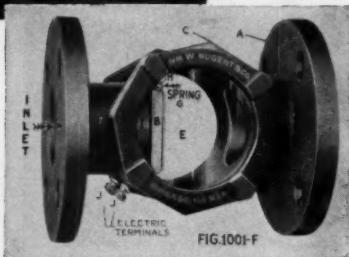
9 models for large machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.



Medium size needle type with steel valve stem. 9 models. Sizes to $\frac{1}{4}$ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

SIGHT FLOW INDICATORS



Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Feed Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.



Wm. W. Nugent & Co., Inc.

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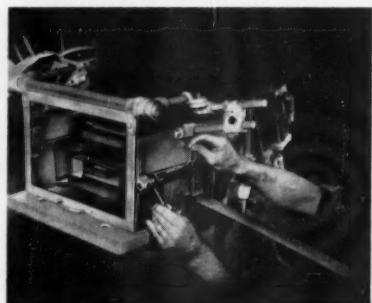
fortable by low-pressure air flowing up and down from a belt connected to a 30-inch air hose. The belt weighs 12 ounces and can be adjusted to fit any waist.

Circle 13E on reply card

Paint removal is made easy, it is said, by the Super Glo-Torch, an electric tool offered by Ludlow Products Corporation. It has a General Electric Calrod 1000-watt, 115-volt ac/dc heating element with a stainless-steel reflector that gives the unit added rigidity. The hardwood handle remains cool to the touch and the reinforced scraper blade can be interchanged with a putty knife. The tool weighs 1½ pounds and is said to remove paint from any wood surface at a maximum rate of 20 feet a minute.

Circle 14E on reply card

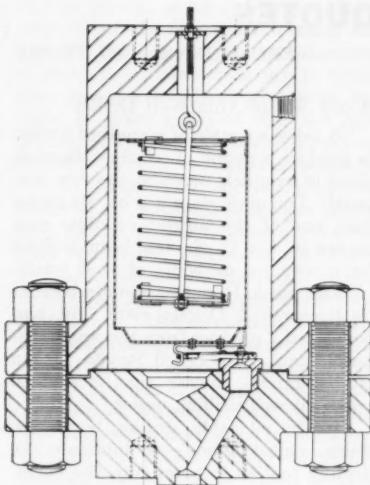
For punch presses limited to primary operations, American Alsafe Company, Inc., has developed an air-controlled die enclosure that is said to insure an unobstructed view of the work, easy setup or die change and operator safety, even from flying particles. The stock and die clamps are shielded by side windows made up of a succession of $\frac{1}{8}$ -inch-thick



Lucite fingers. When closed, hands are kept out of harm's way; when open, the press cannot be tripped. Raising the guard, automatically cuts off the air supply to its foot-pedal valve and clutch cylinder through the action of a cam-operated valve. Shields can be adjusted for different strip stock and die sizes, and fingers can be tightened or loosened by a single nut.

Circle 15E on reply card

For draining water from compressed-air or gas systems at pressures up to 3000 psig where loss of gas is not permissible, Armstrong Machine Works has developed a forged-steel trap that features a noncollapsible, spring-balanced open bucket float. Normally, the weight of the water in the bucket compresses the spring and thus keeps the discharge valve closed. The condensate entering at the top fills the trap body, giving the float added buoyancy. This, plus the spring compression, overcomes the weight of the water and bucket, causing the latter to float and open the valve, thus



allowing the condensate to escape. The water-sealed valve closes before all of it is discharged. At 2000 psig the capacity of the unit is 2000 pounds per hour. Working parts are made of stainless steel and body and cap of chromemolybdenum steel.

Circle 15E on reply card

A saw blade that permits cutting in either direction of rotation and that is self-honing will soon be marketed through industrial and construction distributors. Developed by Skil Corporation, it features teeth of a new form with cutting edges that are said to be 50 percent harder than those of conventional types. The blade is of specially treated alloy steel and has a black finish to make it rust resistant and to eliminate glare. When it becomes dull, it is reversed, and as the saw operates in the opposite direction the sides of the teeth that need resharpening are automatically honed. This can be done frequently without loss in diameter, according to the manufacturer. The 2-way blade is available in three sizes— $5\frac{1}{8}$, $7\frac{1}{4}$ and $8\frac{1}{4}$ inches—all provided with a diamond arbor because they are designed exclusively for Skil saws.



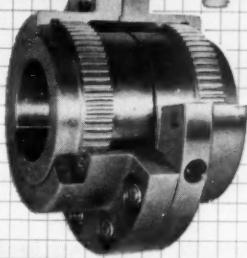
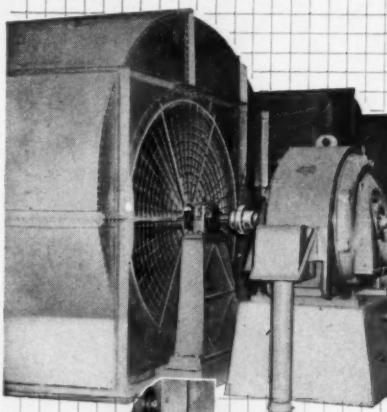
Circle 17E on reply card

WALDRON

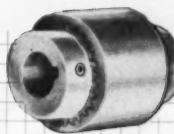
ADVANCED DESIGN

GEAR COUPLINGS

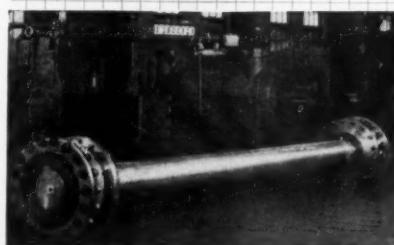
are available in all types and sizes for all applications



Above—Steel Coupling On Tunnel Fan



Above—All Nylon, Non-Corrosive Type



Floating Shaft Type
For Steel Mill



Combination Nylon Hub and Steel Sleeve

WALDRON couplings are available in sizes up to 18" shaft diameter. We specialize in furnishing couplings for unusual applications and services. We would be pleased to send you our latest bulletin 55C upon request.

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Circle 21A on reply card

RECIPE FOR BETTER AIR LINES



When you combine these advantages built into Naylor lightweight pipe, you can count on top performance in air lines for high or low-pressure service:

LIGHTWEIGHT—without sacrifice of strength, assures easy handling and installation.

SAFETY—through the spiralwelded lockseam which acts as a continuous expansion joint to absorb shock loads, stresses and strains.

GREATER COLLAPSE STRENGTH—through the reinforcing spiral truss which permits lines to be operated under vacuum as well as pressure.

FASTER CONNECTIONS—with the one-piece Naylor Wedge-Lock coupling that can be assembled or disassembled with a hammer.

For the complete story on this distinctive lightweight pipe and coupling combination, write for Bulletins No. 507 and No. 514.



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Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York
Circle 22A on reply card

QUOTES

—FROM HERE AND THERE

Wood Waste Aids Well Driller

"It takes a couple of pounds of timber to produce a pound of cellulose, because there is so much waste in the raw material. For more than a year, Rayonier Inc., one of the biggest cellulose producers in the U. S., has been looking for a way to use some of that waste."

"Last week, Rayonier announced that its Research & Development Div. had developed a product from the waste material that . . . is called Rayflo. It's a reddish-brown powder that is said to make oil well drilling easier."

"In the oil fields, drilling teams use fluids—called 'muds'—to lubricate the drilling tool as it bores into the earth. As the drill goes deeper, the mud has to be dense, yet fluid enough to be pumped and recirculated. So the drillers add a thinner to the mud to maintain the density and keep the mud fluid."

"Rayonier's . . . Rayflo is used as the thinner. Up to now, oil companies have had to import a South American wood product, quebracho, to do this job. The company says that it can easily produce as much thinner as the domestic oil industry needs, and that its new product will perform as well as quebracho, and won't cost so much."

Business Week, November 27, 1954

Air Cylinders in Die Presses

"During the past decade, the most beneficial single advancement in improved press tooling has been the introduction and use of the air cylinder. The moving, transferring, ejecting and holding of workpieces by the use of these inexpensive air-powered devices saves time, money, and effort because of their very effective operation under exceptionally difficult conditions."

"By the use of air cylinders or air motors, controlled either pneumatically



"Make up some excuse -- tell him I'm busy."

or electrically, parts can be positively ejected from the dies. Horn forming dies and cam piercing dies are two examples of where exceptional difficulty in workpiece removal has been a problem because in these types of dies the part literally wraps or binds itself to the tool so that it usually becomes impossible to remove it except by mechanical means. Some of the mechanical devices which have been designed to eject parts from these tools have been so unwieldy and grotesque that any breakdown . . . could be repaired only by the die maker who built them. These mechanical monsters have been relegated to obscurity by the adaptation of air cylinders in their stead.

"Air cylinders in high production dies are equipped with automatic valving to eject and return during the up stroke of the press ram. In small lot production, a manually operated valve is used because of its simplicity in setup. The ease with which the air cylinder can be removed from one die and mounted on another has been proved as to practicality even in small lot production.

"The air cylinder with its rather simple controls can be made to move fast or slow, in either direction, simply by turning a screw which permits the air to enter and leave the cylinder in the manner desired. In addition to the forward and backward movements provided . . . the exhaust air can be further utilized to eject slugs or to move the workpiece away from the die after its ejection.

"In automatic progressive multi-station die operation, a problem arises on how to remove the finished workpiece after it has been blanked and dropped through the die onto the bed of the press or bolster. The usual step . . . was to cut an opening in the bed of the press to permit workpiece removal. Naturally, too great an opening in the bed area weakened the press.

"Best results in workpiece removal, when the blank is resting on the bed or bolster, can be achieved by the use of an air cylinder to push the finished piece to the front or back, or to the end of the die. When using this technique, parallels must be used underneath the full length of the die because it is on these parallels that the air cylinder is mounted.

"When pushing the piece from back to front, the air cylinder is mounted on the back parallel and an opening is made in the front parallel to permit the ejection of the piece. When pushing the piece to the end of the die, the air cylinder is mounted on the front parallel and an arm is mounted on the air cylinder shaft. This arm extends through a slot in the parallel so positioned as to clear the opening of the blanking station. The slot in the parallel must be long enough to permit the length of stroke that the air cylinder is to perform.

"This latter technique of moving or transferring the workpiece after it has

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RINGS

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57 YEARS OF PROGRESS

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FRANCE offers you not only the finest engineering and consistent quality in these products, but also the SERVICE demanded by industry.

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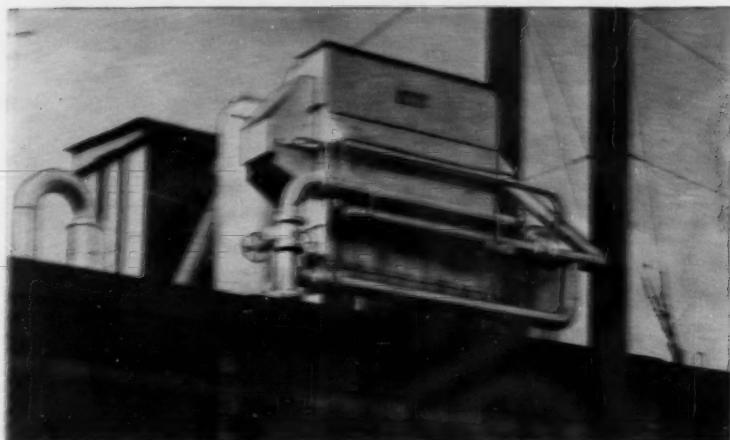
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COMPANY

ADDRESS

Circle 23A on reply card

*Direct saving of cooling water expense returns to you
the cost of a Niagara Aero After Cooler
in less than two years.*



How to Get Drier Compressed Air:

*It prevents many troubles and saves
much expense*

● NIAGARA AERO AFTER COOLER cools compressed air or gas below the temperature of the surrounding atmosphere. Therefore you get no further condensation in your lines. You save much in repairs to pneumatic tools and equipment; you save much interruption to production; you save water damage in paint spraying, in air cleaning, in any process where compressed air comes in contact with your materials or parts in manufacturing (sand blasting, for example).

Niagara Aero After Cooler uses evaporative cooling, saving 95% of your cooling water con-

sumption. This saving quickly returns the cost of the equipment to the owner or makes extra cooling water available for other processes.

The Niagara Aero After Cooler produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. Other Niagara equipment provides bone-dry air for processes requiring it.

If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. CA, 405 Lexington Ave.

New York 17, N.Y.

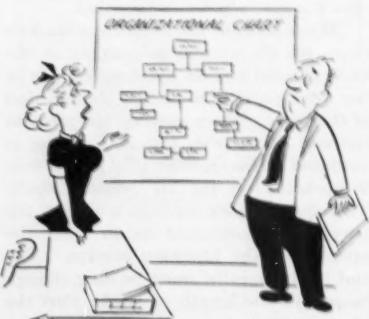
Experienced District Engineers in all Principal Cities
Circle 24A on reply card

been blanked has been the answer to performing operations after blanking which previously had been thought of as being impossible. It has brought about a new type of die known as a two-level automatic progressive die. On this type of die, stamped parts are transferred the proper pitch distance and operations are performed after the part is blanked. The then-finished part is ejected by the blank as the latter is positioned by the air cylinder on the second level.

"Another method of air cylinder transfer technique on a two-level automatic progressive die is employed where the over-all length of the press bed is not enough to accommodate the stations required to complete a stamping. Here the semi-finished blanked stamping is transferred to the front or back by the previously described method. However, the stations required for additional operations would not be an integral part of the die required to produce the first-level stamping, previously referred to as the semi-finished blank. These additional die stations would be mounted outside of the confines of the progressive die, and the dropped-through blank would be fed to the first by the air cylinder. Thereafter, the parts would be fed into any subsequent stations by the parts themselves as they contact one another."

"Still another example of air cylinder usage in two-level dies is the employment of a rotary table on the second level to transfer semi-finished stampings after severance from the strip. The movement of the rotary table, powered by an air cylinder, carries the workpiece in the desired increments which are established by adjustable stops built into the table. The operating cycle of the air cylinder-powered rotary table is initiated by a trigger set to engage an air valve at the crest of the up-stroke of the press. The table is repositioned by the time the press starts its downward movement. Subsequent operations are performed after each rotation, consequently the workpiece is completed and ejected without intermediate handling."

Ernest J. Urbas, Tooling and Production,
November, 1964



"But Mr. Smith, I thought that
was a diagram of the plumbing."

Books and Industrial Literature

The second edition of *Conversion Factors and Tables*, a compilation of conversion data covering practically all known weights and measures and units of velocity, density, viscosity, pressure and energy, is now available. Compiled and edited by Drs. O. T. Zimmerman and Irvin Lavine, it contains more than 12,000 conversion factors and 122 pages of tables. Also included in the 4½ by 6 inch, 525-page volume are definitions and fundamental (constant) values; foreign monetary equivalents; 5-place logarithms; electromotive force-temperature conversions for Chromel-Alumel, Copper-Constantan, Iron-Constantan and Platinum-Rhodium thermocouples; hardness conversion factors and color-scale conversions. The book is published by Industrial Research Service, Inc., Masonic Building, Dover, N. H. Price, \$5 in the United States; \$5.50 abroad.

In an 8-page catalogue The DoAll Company lists varied types and sizes of its precision-ground reamers together with specifications in handy tabular form.

Circle 18E on reply card

A 16-page catalogue, No. 17-D, on installation accessories for lubrication, steam, liquid, hydraulic and air applications is being offered by J.N. Fauver Company, Inc.

Circle 19E on reply card

Facts about CPS (controlled pore size), a woven Teflon cloth for all filtration and dust-bag collection systems, are contained in Leaflet T-112 prepared by Porous Plastic Filter Company.

Circle 20E on reply card

Bulletin HT-1, published by Minneapolis-Honeywell Regulator Company has been prepared to clarify the role of automatic temperature control as it applies to induction heating equipment.

Circle 21E on reply card

The 1955 issue of *Everything in Safety*, a catalogue dealing with personal protective equipment and industrial safety devices, has been released by General Scientific Equipment Company.

Circle 22E on reply card

Aluminum in the Process Industries, an 8-page booklet published by Alcoa, lists the growing number of applications of the metal in that field and points out its economic and technical advantages.

Circle 23E on reply card

Catalogue No. 55 prepared by E.D. Bullard Company illustrates and describes its full line of industrial safety equipment and products. Addresses of all Bullard distributors are listed.

Circle 24E on reply card

The Swartwout Company has announced a new bulletin, A-714, on its Type T3C thermocouple-air converter which enables users to retain their pneumatic recording and controlling panel components and yet take advantage of the company's Autronic system of all-electronic process control.

Circle 25E on reply card

A Better Air Power System is the title of a new engineering-service bulletin obtainable from Ingersoll-Rand Company. The publication points out that power losses in compressed-air lines often amount to as much as 30 to 50 percent and explains how

**CONTINENTAL RED SEAL
means
MORE AND BETTER POWER**



Ingersoll-Rand GR-105 Compressor, supplying air for PB8 paving breakers. Power — Continental Red Seal F-162.

Continental Red Seal power for specialized applications is now available at levels ranging from 2 h.p. up to more than 1,000, in liquid-cooled and air-cooled models, for use on all standard fuels. And, strictly on the score of PERFORMANCE—economy, dependability and low maintenance cost—it is finding its way into more and more leading makes of specialized machines. The equipment builder's good name, and the end-user's satisfaction, are double-clinched by this fact: **EVERY CONTINENTAL RED SEAL IS NOT ONLY BUILT FOR ITS JOB, BUT BACKED BY PARTS AND SERVICE FACILITIES COAST TO COAST.**

**NO OTHER ENGINE GIVES YOU ALL THESE ADVANCED
ENGINEERING FEATURES**

PATENTED INDIVIDUAL PORTING — FULL-LENGTH WATER JACKETS

TOCCO-HARDENED COUNTERBALANCED CRANKSHAFT

ALLOY STEEL VALVE SEAT INSERTS — LEAKPROOF WATER PUMP

PATENTED OIL AND DUST SEALS — POSITIVE ROTATION EXHAUST VALVES

A COMPLETE LINE OF 4-CYCLE AIR-COOLED ENGINES

Continental also builds air-cooled models, from 2 to 3 h.p., for heavy-duty applications in industry and on the farm. They embody the exclusive Contex® external ignition system, greatest air-cooled engine advance in recent years. For information, address Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15.

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 910 S. BOSTON ST., ROOM 1008, TULSA, OKLA.
1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.



Continental Motors Corporation
MUSKEGON, MICHIGAN

NEW

TOLEDO VISE STAND

a Sturdy Lightweight Work Bench!

BUILT-IN TRAY
folds for easy
carrying



Handy new Toledo No. 8 Vise Stand goes to any pipe-fitting job easily . . . sets up or takes down quickly

. . . saves time and effort. All one unit, no loose parts. Extra rugged, won't fold up in use. Large size vise base for easy mounting of Toledo or other vises. 3 pipe benders, plenty of tool slots, pipe rest, ceiling brace. See it now—a great value at your supply house!

NEW

TOLEDO PIPE VISE

Exclusive
ROCKING-WEDGE
ACTION JAWS



Small Pipe
from 1/8"



Larger Pipe
to 2 1/2"



Tees, Ells
Valves

Grips any shape without crushing. Jaw action tends to eliminate marking of pipe. Heat treated jaws. Capacity—No. 1 Vise, 1/8" to 2 1/2". Order through your supplier.

THE TOLEDO PIPE THREADING MACHINE CO.
Toledo 4, Ohio

"TOLEDO"

TRADE-MARK

REGISTERED
U. S. PAT. OFFICE

Builders of the
World's Finest
Pipe Tools

PIPE THREADERS
PIPE WRENCHES
POWER PIPE MACHINES

to determine if the cost of the air being wasted exceeds the cost of repairing or renovating the distribution system. Step by step it tells how to bring air lines up to accepted standards. The booklet also gives helpful hints on how to design a system and contains diagrams of different networks, as well as tables of friction losses in hose, pipes and fittings.

Circle 26E on reply card

The Garlock Packing Company has released a catalogue, No. AD-148, on its complete line of O-Rings. The publication gives design information, recommended pressures and materials available for both dynamic and static applications.

Circle 27E on reply card

A check list of basic rules for the use and care of industrial rubber hose is offered to plant maintenance engineers and other users by the Thermod Company. The lacquer-protected 8 1/2 x 11-inch chart is designed for wall-mounting.

Circle 28E on reply card

General Industrial Company is offering a catalogue listing its office, mail- and stockroom equipment. Among the new items described are plastic drawer cabinets and a wireless intercommunication system that can be plugged into any electric outlet.

Circle 29E on reply card

Application and engineering data on standard control units for automatic machine control, gauging, classifying and for segregating processes are contained in an illustrated catalogue, No. AU-1154, being distributed by The Sheffield Corporation.

Circle 30E on reply card

Titanium and tubing made from it are discussed in Bulletin No. 43 published by Superior Tube Company. It tells how this newest member of the metal family is heat treated, pickled, welded, brazed and machined and lists applications.

Circle 31E on reply card

Bucyrus-Erie 15-B transit crane, a mobile 1/2-cubic-yard machine that can be converted into a shovel, dragline or clamshell for a wide range of lifting and excavating jobs, is fully described and illustrated in a bulletin which will be mailed upon request.

Circle 32E on reply card

To get the best results with carbides for cutting metals, fibers, plastics and rubber, General Electric's Carboly Department has published *Selection of Carboly Grades and Suggested Speeds* as a supplement to Section Three of its Tool Manual GT-191.

Circle 33E on reply card

Cookroc, a laminated Bakelite, and packing and piston rings made from it are fully described in Bulletin No. 500 being distributed by C. Lee Cook Company. The material is available in three grades—standard, graphitized and high-temperature—to meet varying pump and compressor needs.

Circle 34E on reply card

Leaflet 124 released by Niagara Blower Company deals with its Aero Heat Exchanger by means of which water, oil, compressed air or other gases are cooled under precise temperature control. It has a wide field of application in chemical-processing, metalworking and other industries.

Circle 35E on reply card

Full details about a line of flame arresters are contained in a leaflet issued by Air-Maze Corporation. Mounted on the ends of vent pipes, the units are designed to

keep sparks and flames out of storage tanks containing volatile liquids. This is done by a series of wire baffles which also prevent drawing in foreign matter and contaminating the contents.

Circle 36E on reply card

A 36-page catalogue (B-6505) issued by Westinghouse Electric Corporation contains a list of its 16-mm sound motion pictures and slide films available upon a loan basis for showing by church, social, professional, civic, business and other organized groups. The films, both in color and black and white, cover a variety of subjects.

Circle 37E on reply card

Reliance Electric & Engineering Company's Bulletin C-2002 fully describes its completely new line of direct-current motors that are said to do the work generally performed by machines of special design. Now available in sizes from 20 to 100 hp, the Super 'T' is built for "dynamic response" required by present-day high-speed operation in mill and factory.

Circle 38E on reply card

Worn air-gauging members of all types are being reconditioned by Freeland Gauge Company by a method developed by it. It has been applied with success to steel, chrome-plate, tungsten-carbide and other gauge materials, it is claimed, and the company guarantees that all work done meets specifications. The service, which is said to be unique, is explained in a booklet that can be obtained upon request.

Circle 39E on reply card

Good Lighting is Good Business is the title of a booklet released by Sylvania Electric Products Inc. Written in nontechnical language by engineers with extensive experience in this field, it covers such topics as layout and planning, maintenance, room finishes and color, quantity of light, light distribution and natural lighting. Various systems are discussed, as well as lighting for areas other than offices.

Circle 40E on reply card

A 58-page general catalogue on industrial rubber products manufactured by Quaker Rubber Corporation, Division of H.K. Porter Company, Inc., is available for distribution. Fully illustrated, it is divided for quick reference into sections on belting, hose, packing and molded rubber products. Also contains information on different types of hose couplings, on how to select hose for a given purpose and how to lengthen its life.

Circle 41E on reply card

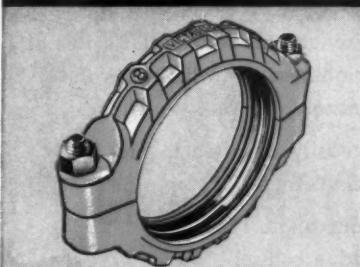
Johns-Manville has published a 6-page folder on Thermoflex, a multipurpose refractory-fiber felt for service at temperatures up to 2000°F. Originally developed as an insulation for jet engines, it has many additional uses such as a filter medium for hot gases and liquids, as a sound-control material where the presence of intense heat complicates the noise-absorption problem, as a refractory packing and fill, etc.

Circle 42E on reply card

Rigid plastic pipe and fittings is the subject of a catalogue offered by Alpha Plastics, Inc., 14 Northfield Road, West Orange, N.J. The company makes normal- and high-impact unplasticized polyvinyl-chloride piping in sizes from $\frac{1}{2}$ to 4 inches, and the object of the booklet is to bring design, maintenance and application engineers up to date as to its properties, characteristics and uses based on company tests, field experience and users' reports. Requests must be written on letterheads.

VICTAULIC

METHOD OF PIPING

VICTAULIC COUPLINGS

Styles 77, 77-D for standard applications. Simple, fast to install—sturdy and reliable. Sizes $\frac{3}{4}$ " to 30". Style 75 Light-Weight Couplings for light duty applications. Sizes 2", 3", 4". Additional styles for cast iron, plastic and other pipes. Sizes through 60".



VICTAULIC FULL-FLOW FITTINGS

Complete line of Elbows, Tees, Reducers, Laterals, etc.—to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes $\frac{3}{4}$ " to 12".



VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle—operate manually or from any power drive. Automatic groove position and depth. Sizes $\frac{3}{4}$ " to 8".



ROUST-A-BOUT COUPLINGS

Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky—easy and fast to install. Takes strong bulldog grip on pipe. Sizes 2" to 8".



VICTAULIC SNAP-JOINTS

Victaulic's new boltless, speed coupling. — Style 78 — hinged into one assembly. Hand-locks for time and dollar savings. Sizes 1", $1\frac{1}{4}$ ", 2", 3", 4".

EASIEST WAY TO MAKE ENDS MEET

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog-Manual 55-3B

**VICTAULIC
COMPANY OF AMERICA**
P. O. Box 509 • Elizabeth, N.J.

an AIR engineering FIRST

New ANGLE WRENCH

with unmatched Torque Control

Ingersoll-Rand introduces a brand new concept in torque control in angle wrenches. This sensational new development shuts off automatically and completely—it does not continue to build up torque.

The New Torque Control Angle Wrench runs series after series of nuts or cap screws to the same tightness . . . eliminates the inaccuracies of former angle wrenches.

- **Easy Adjustment**—quickly and easily adjusted to produce any torque within the selected range.
- **More Durable**—than any previous angle type nut runner. New "valve type" torque control mechanism is less vulnerable to wear . . . more economical to maintain.
- **Minimum Torque Reaction**—transmitted to operator, regardless of torque setting . . . for the life of the tool.
- **Seven Sizes** — to choose from—torque range from 5 to 90 foot pounds.



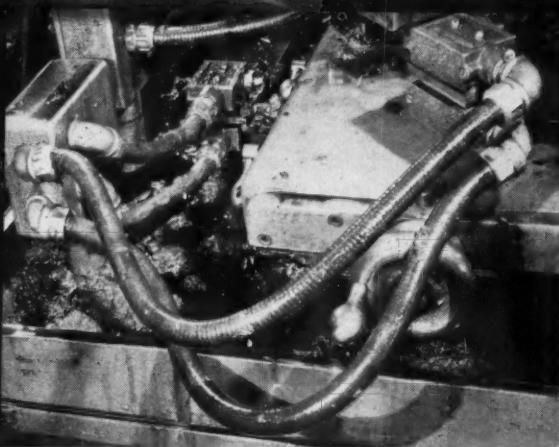
size 38MT

8-188

Ask your Ingersoll-Rand AIRengineer to demonstrate the new I-R Torque Control Angle Wrench . . . phone him today . . . or write for more information on this new development.

Ingersoll-Rand

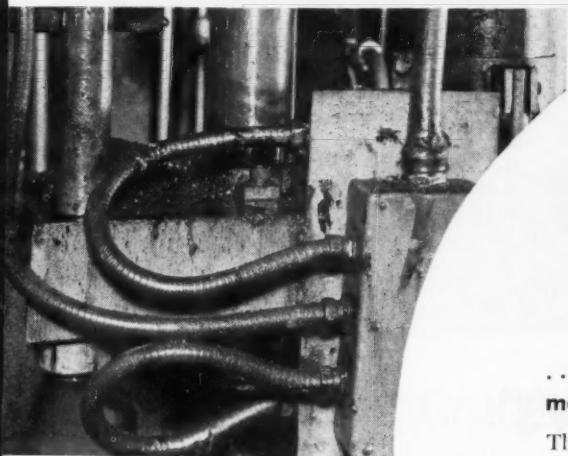
11 Broadway, New York 4, N.Y.



Production grinder moves back and forth, continuously flexing Sealtite and spewing metal dust, oil and coolant over it.



Sealtite resists oil, chlorine, caustic soda and wet pulp protecting leads to motor in paper mill.



Oil, grease and water from hydraulic press can't hurt wiring protected by Sealtite. Type E.F., used here, is extra flexible to make small-diameter U-bends, hug machine tool contours.

TYPE U.A. Sealtite flexible, liquid-tight conduit. Tough polyvinyl jacket over interlocked, zinc-plated steel strip. Copper conductor wound spirally in the space between each convolution on the inside of the conduit.

Give SEALTITE the dirtiest jobs around the plant

... this liquid-tight, flexible conduit protects wiring against moisture...oil...chemicals...weather...mechanical damage.

There are good reasons why you see Sealtite* protecting wiring on these dirty, critical jobs. It won't corrode. Nothing gets through its tough, extruded polyvinyl outer jacket. And day in, day out, Sealtite stands up under continuous flexing...gives maximum protection wherever wiring must connect moving parts...absorb vibration...follow contours...house wires with maximum protection. More, you save the installation time it takes to bend and fit rigid conduit.

TYPE U.A. is approved by Underwriters' Laboratories for service in wet spots. Copper conductor wound spirally inside conduit for positive ground.

TYPE E.F.† is extra flexible. Ideal for machine tool applications. Meets J.I.C. standards. Now available in machine tool standard light gray at no extra cost from mill stocks.

*Trade mark

†Patent Applied For

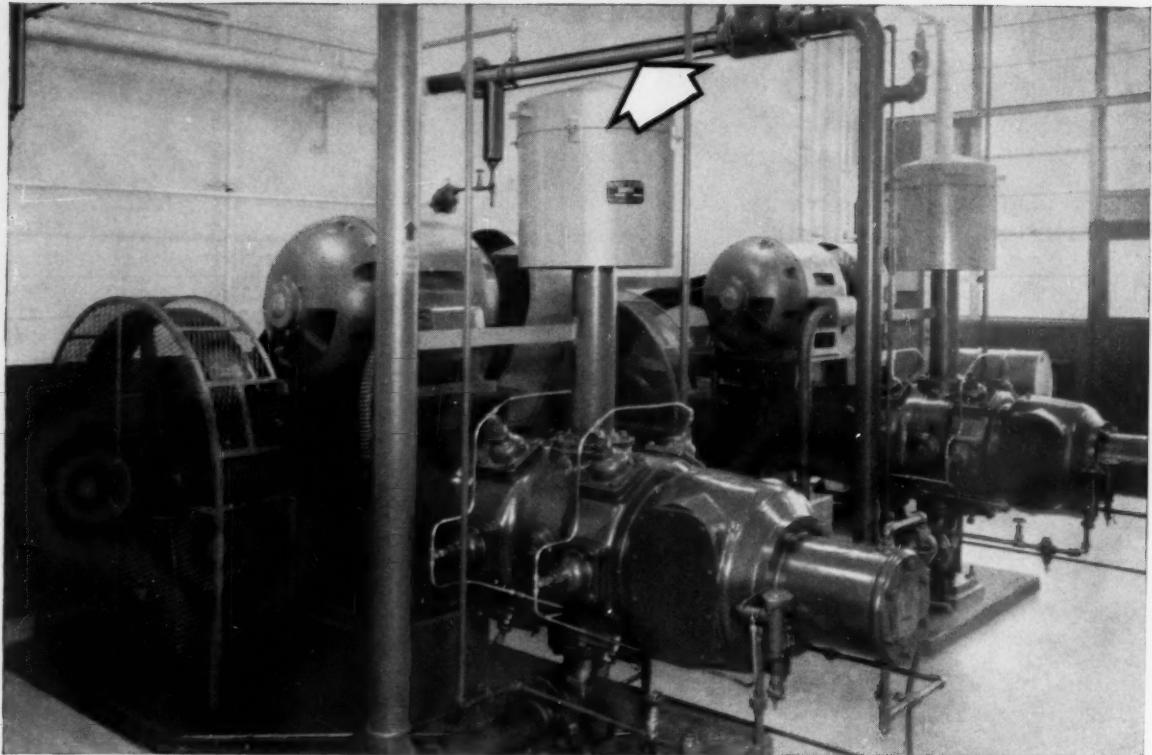


SEALTITE
FLEXIBLE,
LIQUID-TIGHT CONDUIT

ELECTRICAL WHOLESALERS stock both types in easy-to-handle coils. Buy it in long, random lengths; cut it on the job without waste. Electrical Wholesalers also stock liquid-tight connectors. For complete information write for Sealtite bulletins. Address *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.*



an **ANACONDA®** product



Ross Aftercoolers

assure clean, dry compressed air for radio and TV tube production

Delivering compressed air at 100 psig to production machinery used in manufacturing radio, TV and electronic tubes, diodes and transistors, each of these motor-driven, single-stage air compressors has a capacity of 425 cfm.

To eliminate moisture and oil vapor from the compressed air as it is discharged from the compressors, a Ross Pipeline Aftercooler, complete with moisture separator, has been connected directly to the discharge line check valve of each unit. Cool, dry, clean compressed air is thus assured at all times for the proper functioning of air operated equipment and for the protection of pipe lines and gaskets.

Compactly designed, Ross Aftercoolers are easy to install. Like Ross Cylinder-Mounted-Intercool-

ers, Lube Oil Coolers and Jacket Water Coolers, they are widely preferred for their extreme ruggedness and high heat exchange efficiency. All are available in a wide range of standard designs and sizes to answer practically every air, gas, oil and water cooling requirement.

Descriptive literature will be mailed promptly on request. Write, mentioning the type of cooling equipment and compressor application in which you are interested.

KEWANEE-ROSS CORPORATION

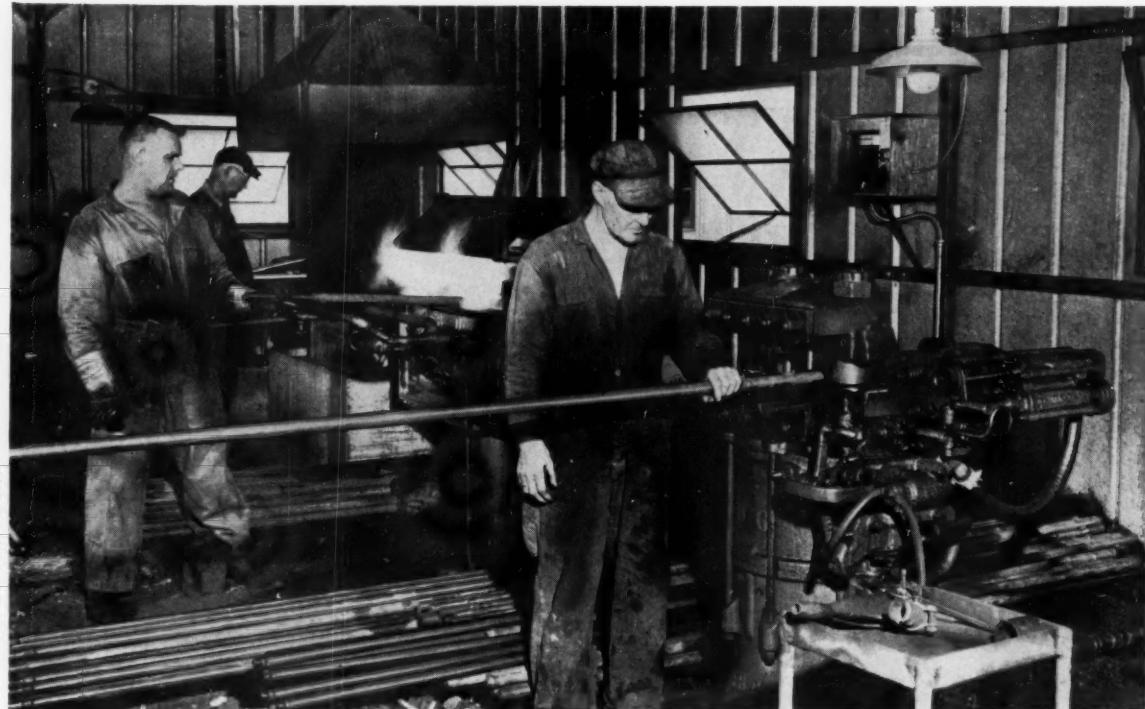
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

1471 WEST AVENUE • BUFFALO 13, N.Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.



AFTERCoolERS
INTERCOOLERS
LUBE OIL COOLERS
JACKET WATER COOLERS

Serving home and industry: AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



Blacksmith Billy Watkins shanking a Crucible Hollow Drill Rod.

they're using Crucible Hollow Drill Rods on the Boston Tunnel Jobs ...

400-feet below the city of Boston, two seven-mile tunnels are being cut through solid rock. Replacing century-old mains, the tunnels will bring water from Quabbin Reservoir, 70 miles away, and remove drainage from the city.

On this job, like most other tough ones, Crucible Hollow Drill Rods are in daily use. For experienced construction men *know* they can depend upon Crucible Hollow Drill Rods for top performance at *lowest cost per foot of hole drilled*.

That's because they are made to *tool steel* standards by the nation's leading producer of *special steels*. So for extra dependability on *all* your drilling jobs specify Crucible Hollow Drill Rods. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*



120-foot-high head frame
used to raise and lower men
and materials in excavation
shaft. Morrison-Knudsen-
Kiewit-Maney City Tunnel Ex-
tension Job, Boston, Mass.

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America

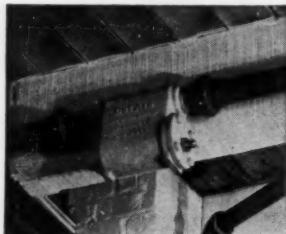
DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

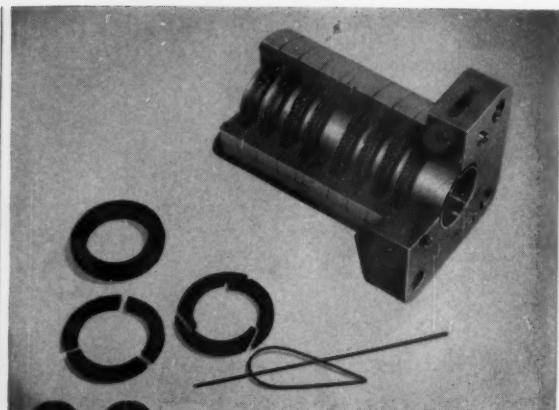
DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY
PLAINFIELD, NEW JERSEY

ADV. 35

Circle 32A on reply card



Look to COOK for Better CARBON PACKING RINGS!

Cook carbon packing rings are made of a special carbon graphite material that automatically assures you *high resistance to wear, chemical inertness and excellent heat conductivity*.

If you have sealing requirements for non-lubricated compressors, write today for a sample carbon ring, plus

literature on Cook's complete line of packing materials. Address C. Lee Cook Manufacturing Co., 916 South Eighth Street, Louisville 3, Ky.

C.LEE COOK MANUFACTURING CO.

Sealing Pressures Since 1888

Circle 33A on reply card

CUT Cooling Water Consumption 50% —increase compressor efficiency



Schramm water-cooled, stationary air compressors, as shown, are equipped with Sarco rigid stem cooling controls, type TR-44R, as a recommended accessory.

These controls cut the water consumption to what is actually needed to protect the compressor.

They prevent impaired lubrication, often the result of overcooling. They are installed directly in the water piping, take up no extra space—require no attention. A Sarco strainer is installed ahead of the control valve.

Write for Technical Bulletin No. 5 to *Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.*

Advt. 614

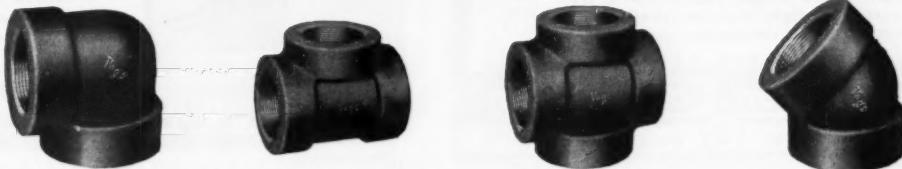


COMPRESSED AIR MAGAZINE

Circle 34A on reply card

STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes $\frac{1}{8}$ " to 6"

SCREW END TYPE



For schedules 40, 80 and 160 pipe — Sizes $\frac{1}{8}$ " to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

Vogt

A small figure of a man carrying a sign that reads "Vogt FOR BETTER FITTINGS".

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

**DROP FORGED
STEEL FITTINGS**

**NO MOISTURE
OR DIRT
GETS BY HERE**

**Johnson
Self-Draining
Compressed Air
Separator.....**

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

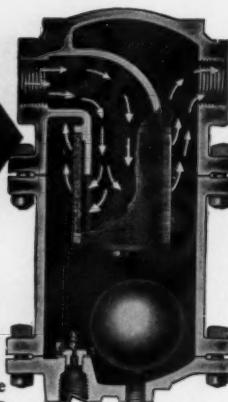
1. Controlled expansion of air in separator precipitates most of the moisture.
2. A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining foreign matter.

Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

WRITE FOR CATALOG

The Johnson Corporation
830 WOOD STREET  THREE RIVERS, MICH.

Circle 36A on reply card



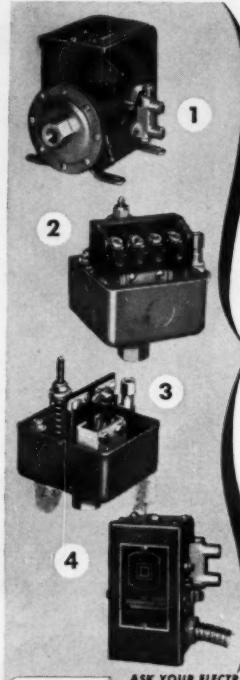
Johnson Separation Devices include Separators for Compressed Air or Steam, After coolers, oil absorbers.

SQUARE D

**FOR A
Complete Line
OF H.P. RATED
AIR COMPRESSOR
SWITCHES**

- 1 Heavy Duty
 - 2 Standard Duty
 - 3 Gas Engine Cut-Out
 - 4 Magnetic Unloader
- full range of electrical and pressure ratings

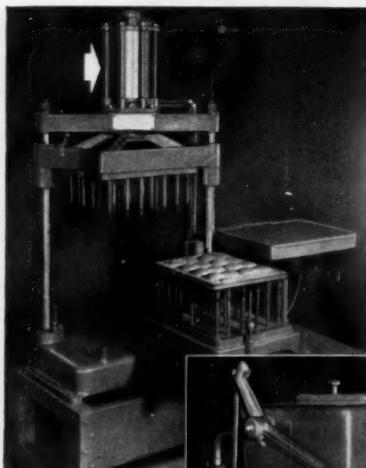
*Write for Bulletin 550,
Square D Company, 4041 North
Richards St., Milwaukee 12, Wis.*



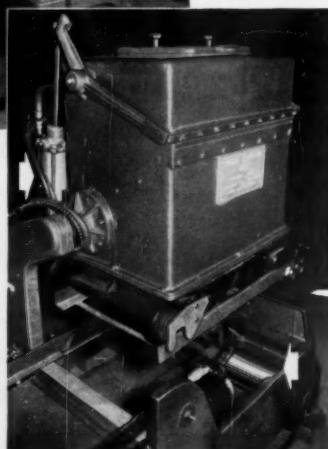
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

Circle 37A on reply card



Shell Process Bonding Machine Equipped with NOPAK 8" Model D Cylinder.



This machine which produces shell molds employs 2 NOPAK Cylinders to invert investment box and to open the louver which releases the mix.

SHELL PROCESS Equipment Utilizes NOPAK Cylinder Power

Builder of "Shell Molding" Equipment... Shell Process, Inc., of Chicopee, Mass., employs NOPAK Cylinders in a number of its machines to provide the controlled power necessary for their successful operation.

The top illustration shows a bonding machine utilizing the shell molds produced in the machine pictured below. An 8" Model "D" NOPAK Cylinder advances and retracts the upper pressure plate which, in turn, applies the pressure, through pins and springs, required to seal the two halves of the shell mold before molten metal is poured between them.

The lower picture shows a machine which produces shell molds by the investment process, employing a 4" NOPAK Cylinder to operate the louver of the investment box containing the sand and resin mix which is deposited on the heated pattern. A 6" NOPAK Cylinder, visible in base, rotates the investment box 210°.

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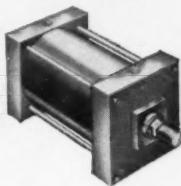
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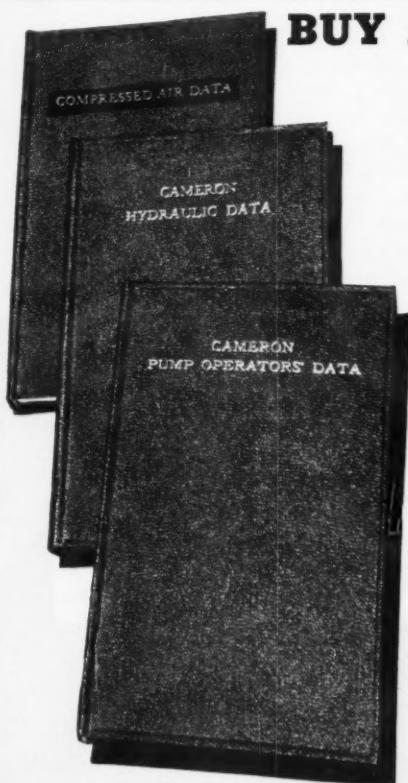


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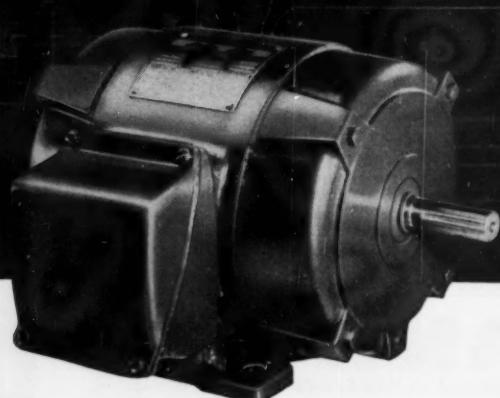
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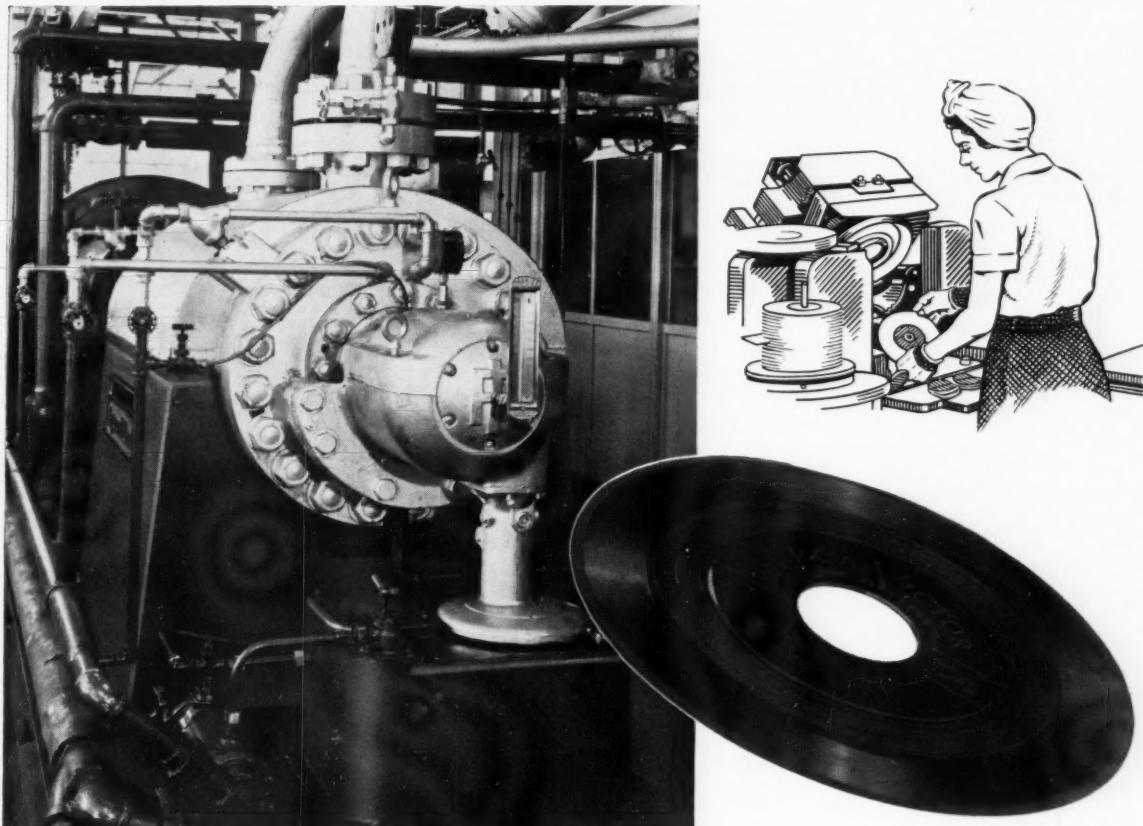
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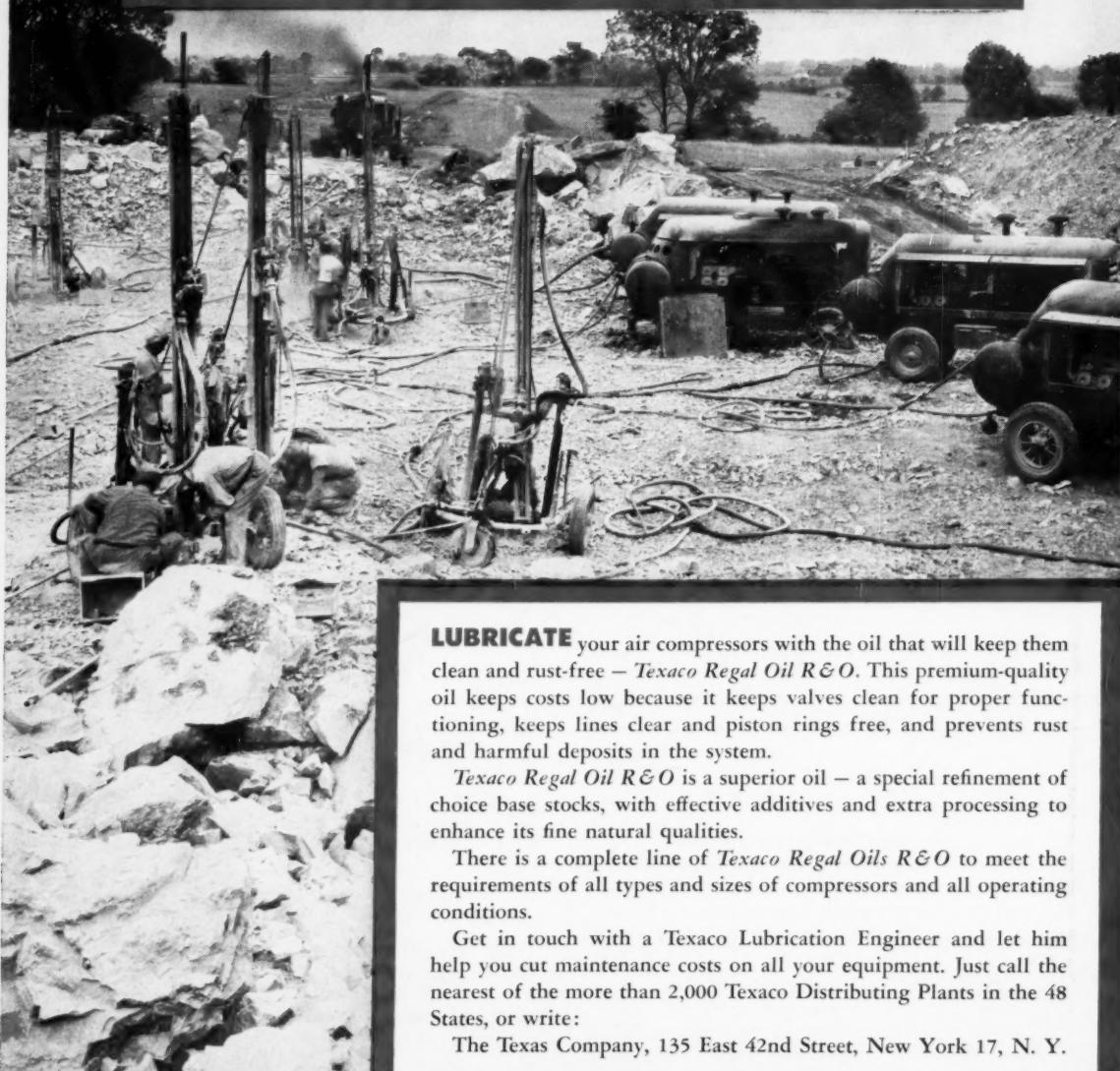
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